

THE IMPACT OF THREE DIFFERENT PHYSICAL ACTIVITY RECOMMENDATIONS ON PHYSICAL ACTIVITY

by

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Current physical activity guidelines encourage adults to accumulate 150 minutes of moderate intensity aerobic physical activity each week to improve health. Recommendations based on these guidelines typically focus on promoting moderate-to-vigorous physical activity (MVPA) without discouraging sedentary behavior throughout the day. This study aimed to determine the impact of various physical activity recommendations on physical activity, self-efficacy, and enjoyment, and to examine relationships among self-efficacy, enjoyment, and physical activity. This study consisted of a 1-week baseline and a 4-week intervention in which 42 healthy adult participants were randomly assigned to one of three intervention groups or a control group. Those assigned to an intervention group were recommended to achieve a physical activity goal based on (a) steps, (b) minutes, or (c) a combination of steps and minutes. There were no statistically significant group x time interactions for step counts or minutes of MVPA. A series of repeated measures ANOVAs revealed that the minutes group showed the largest increase in minutes spent in MVPA ($d = 0.50$) over the course of the intervention, and that all three intervention groups had similar increases in step counts. The control group experienced a decrease in both step count ($d = -0.88$) and minutes spent in MVPA ($d = -0.36$) over the course of the study period. None of the groups experienced an increase in self-efficacy. Comparisons between groups revealed that the steps group experienced the largest increase in enjoyment levels from T1 to T2 ($d = 0.47$), followed by the minutes group ($d = 0.14$). The combination

group and control group both experienced no change in enjoyment level from T1 to T2 ($d = 0.07$, $d = -0.04$), respectively. Findings from this study suggest the need for future interventions to increase self-efficacy and enjoyment as both are known to be important for the adoption and maintenance of physical activity behavior.

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PHYSICAL ACTIVITY

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CHAPTER 1: INTRODUCTION

In 2008, the U.S. Department of Health and Human Services presented the updated Physical Activity Guidelines for Americans (U.S. Department of Health and Human Services, 2008). The guidelines state that adults should engage in 150 minutes of moderate intensity aerobic physical activity or 75 minutes of vigorous intensity aerobic physical activity per week for substantial health benefits, however, accumulating more activity leads to greater health benefits (U.S. Department of Health and Human Services, 2008). These guidelines can be met in 10 minute or greater bouts of physical activity. Although the importance of meeting physical activity guidelines is emphasized in the 2008 Physical Activity Guidelines for Americans, over half (52.5%) of the population fails to meet aerobic physical activity recommendations (Schoenborn & Stommel, 2011). According to accelerometer data, less than 10% of adults meet the physical activity guidelines (Tucker et al., 2011).

Many chronic diseases that Americans experience, including cardiovascular disease, diabetes, hypertension, and some cancers, may be alleviated or prevented by regular physical activity participation (Warburton et al., 2006). An inverse correlation exists between amount of aerobic activity and risk of premature death such that the more time a person spends in aerobic activity, the lower his or her risk is for premature death (Zhao et al., 2013). Alternatively, the more time a person spends sitting, the higher his or her risk is for chronic diseases, mental health problems, and premature death (Tremblay et al., 2010). For these reasons, it is important to know the most effective recommendations for increasing levels of physical activity in the adult population.

To meet physical activity guidelines, several studies have provided recommendations for daily physical activity goals that include: 10,000 steps, one continuous 30-minute bout of

moderate-to-vigorous physical activity (MVPA), or three 10-minute bouts of MVPA. One study in which the three recommendations were compared showed that activity guidelines aimed at step-count or one 30-minute bout of exercise produced greater increases in steps per day and MVPA than three 10-minute bouts of MVPA (Samuels et al., 2011). Several other studies have supported the finding that step-count goals were more effective for increasing levels of physical activity than minute-based goals (Baker, Mutrie, & Lowry, 2011; Hultquist, Albright, & Thompson, 2005; Pal, Cheng, & Ho, 2011). When participants were instructed to either accumulate 3,000 additional steps per day above baseline (using a pedometer) or accumulate 30 additional minutes of MVPA above baseline, people walked more when guidelines were given in terms of step-count rather than minutes (Baker et al., 2011). Similarly, when participants were instructed to either walk 10,000 steps per day or walk for 30 minutes per day, those in the 10,000-step group walked approximately 2,000 steps more per day as compared to those in the 30-minute group (Hultquist et al., 2005). Furthermore, a study by Pal et al. (2011) found that when participants were instructed to either walk 10,000 steps per day or walk for 30 minutes per day, those in the step-count group showed a significant increase in number of steps taken at 12-weeks compared to baseline whereas those in the minutes group did not. Recommendations emphasizing step count have been shown to produce greater increases in physical activity than minute-based recommendations (Baker et al., 2011; Hultquist et al., 2005; Marshall et al., 2009; Pal et al., 2011; Tudor-Locke et al., 2011), and continuous bouts of MVPA have been shown to be more effective than multiple short bouts of MVPA (Samuels et al., 2011). However, a combination of these recommendations has yet to be examined.

Despite the success of the 10,000 steps per day and 30-minute bout of MVPA per day recommendations for increasing physical activity, there are drawbacks to both of these

recommendations. The 10,000 step count recommendation might encourage people to be more active throughout the day, but these steps only count towards meeting national guidelines for physical activity if they are moderate-to-vigorous in intensity. Similarly, engaging in 30 minutes of MVPA per day does not require being active throughout the day. People following the 30 minutes of MVPA recommendation may be sitting during the majority of their day, leading to deleterious health outcomes (Biswas et al., 2015). Even when daily MVPA recommendations are met, sitting can lead to poor health (Ekelund et al., 2016) including increased risk for metabolic syndrome and type 2 diabetes (Hamilton et al., 2007). Thus, a combination recommendation (10,000 steps per day and 30 minutes of MVPA) may be a better approach than either recommendation alone to encourage people to move more throughout their daily lives and accrue MVPA that counts towards meeting physical activity guidelines. However, it is unknown how a combination recommendation would affect physical activity adherence.

Adherence to any physical activity recommendation requires self-efficacy, goal-setting, and enjoyment which interrelate to influence physical activity behavior. Social cognitive theory states that self-efficacy is an important factor in motivation, action, and personal change (Bandura, 2004). Individuals with high levels of self-efficacy are more likely to adopt and maintain physical activity behavior (Tavares et al., 2009), set higher goals for themselves (Locke & Latham, 2002), and find physical activity more enjoyable (Hu et al., 2007) than those with lower levels of self-efficacy. Goal-setting is an effective method for changing physical activity behavior (McEwan et al., 2016) and should be focused on activities the individual finds enjoyable. Higher levels of enjoyment result in increased physical activity (Dishman et al., 2005) and may contribute to long-term adherence (Hagberg et al., 2009). When an individual has high levels of exercise self-efficacy, goal-setting, and enjoyment, physical activity behavior is more

likely to be adopted and maintained (Hu et al., 2007; Locke & Latham, 2002; Tavares et al., 2009).

Self-efficacy is a strong predictor of the adoption and maintenance of physical activity behavior (Williams & French, 2011). Therefore, an intervention aimed at increasing self-efficacy may consequently result in greater increases in physical activity. In the study by Samuels et al. (2011) self-efficacy decreased in all three groups (10,000 steps, 30-min MVPA, 10-minute bouts) even though physical activity levels increased. In the study by Baker et al., (2011) walking levels were not sustained over time after an initial increase in activity. Self-efficacy was not measured in their study, but self-efficacy may have had an effect on walking levels measured over the longer term. Self-efficacy should be measured in physical activity interventions and interventions should aim to increase self-efficacy because of the strong relationship between high levels of self-efficacy and the adoption and maintenance of physical activity behavior (Williams & French, 2011).

Although physical activity guidelines are clearly stated, less than half of the American population engages in the amount of physical activity needed for health benefits (Schoenborn & Stommel, 2011). Current physical activity recommendations may not be appropriate as neither encourages MVPA while simultaneously discouraging sedentary behavior throughout the day. No studies to date have examined the impact of a combination of current physical activity recommendations (10,000 steps and 30 minutes of MVPA) on physical activity or on self-efficacy and physical activity enjoyment.

Purposes & Hypotheses

The purposes of this study are (1) to determine the impact of three different physical activity recommendations on physical activity (step counts and MVPA), (2) to examine the impact of three different physical activity recommendations on self-efficacy and enjoyment, and (3) to examine relationships among self-efficacy, enjoyment, step-count, and minutes of MVPA at baseline (T1) and week 4 (T2) and changes in these variables from T1 to T2. It is hypothesized that a combination recommendation (step counts and MVPA) will have a greater impact on increasing physical activity levels than either a step count or MVPA recommendation alone by encouraging MVPA and encouraging physical activity throughout the day. It is also hypothesized that self-efficacy and enjoyment will increase equally across all groups when recommendations are given as smaller gradual goals relative to baseline physical activity, and self-efficacy and enjoyment will be positively associated with physical activity at T1 and T2 and changes in self-efficacy and enjoyment will be positively associated with changes in physical activity from T1 to T2.

Significance of Study

Increasing physical activity has positive health benefits, yet a large portion of the population does not meet the physical activity recommendations. This study aims to determine the impact of different physical activity recommendations to achieve increases in physical activity, self-efficacy, and enjoyment in the general population, thus, reducing the risk of obesity, diabetes, hypertension, osteoporosis, certain cancers, cardiovascular disease, mental health problems, and premature death in the general population.

CHAPTER 2: REVIEW OF THE LITERATURE

The purpose of this study is to determine the impact of various physical activity recommendations on physical activity, self-efficacy, and enjoyment, and to examine relationships among self-efficacy, enjoyment, step-count, and minutes of MVPA at T1 and T2. This will help researchers and physical activity professionals determine effective ways to help individuals increase their physical activity. In this section, I will discuss ways in which physical activity recommendations are commonly given. Next, I will discuss Social Cognitive Theory with a focus on goal setting, self-efficacy, and enjoyment. Lastly, I will identify the focus of this study and current gaps in the literature.

Physical Activity Guidelines

According to the *2008 Physical Activity Guidelines for Americans*, adults should engage in at least 150 minutes of moderate intensity physical activity or 75 minutes of vigorous intensity physical activity per week for substantial health benefits. Regular physical activity aids in the prevention of a variety of chronic diseases including cardiovascular disease, diabetes mellitus, colon cancer, breast cancer, obesity, hypertension, osteoporosis, osteoarthritis, and depression (Warburton et al., 2006). The risk of premature death is reduced with increased aerobic activity (Zhao et al., 2013) and an increase in physical fitness (Warburton et al., 2006). It has been shown that accumulating at least 30 minutes per day of moderate to vigorous physical activity is associated with lower body fat percentages (Bailey et al., 2015). Sedentary behavior, independent of physical activity, increases the risk of obesity, certain cancers, cardiovascular disease, mental health problems, and premature death (Ekelund et al., 2016; Tremblay et al., 2010).

Rates of Physical Activity

Although it is known that increasing daily physical activity has positive health benefits, a small percentage of the population actually achieves the recommendations set forth by the U.S. Department of Health and Human Services. Schoenborn and Stommel (2011) examined physical activity levels for U.S. adults using data collected from the 1997–2004 National Health Interview Survey and found that over half (52.5%) of the population did not meet the *2008 Physical Activity Guidelines for Americans*. Further, only 41.3% of the population accumulated at least 150 minutes of aerobic activity per week (Schoenborn & Stommel, 2011).

Tucker and colleagues (2011) showed that adults over-report their level of physical activity. In one study, adults reported 324 minutes per week of moderate physical activity and 73 minutes per week of vigorous physical activity (Tucker et al., 2011). However, according to their accelerometer data, adults engaged in moderate activity for 45 minutes per week and vigorous activity for 18 minutes per week (Tucker et al., 2011). In this study, 62% of adults met the physical activity guidelines according to self-reported data but only 9.6% of adults met the physical activity guidelines according to accelerometer data (Tucker et al., 2011). These findings suggest that the percentage of the population who meet the physical activity recommendations may be much lower than estimated.

Centers for Disease Control and Prevention (CDC) examined the prevalence of Americans self-reporting meeting physical activity guidelines. To count toward meeting the aerobic activity guideline, aerobic activities had to be performed for at least 10 minutes per episode. Among the U.S., just over half (51.6%) of adults met the aerobic activity guideline according to the CDC (Harris et al., 2011). Therefore, it is important to examine ways in which physical activity levels can be increased among the general population.

Raynor and Jankowiak (2010) examined physical activity levels and step counts in college students. Of the 200 participants, only 20.3% met physical activity guidelines with 16.7% accumulating at least 150 minutes of moderate intensity physical activity per week and 3.6% accumulating at least 75 minutes of vigorous physical activity per week (Raynor & Jankowiak, 2010). When number of steps was examined, it was found that 42.9% of students took at least 10,000 steps per day (Raynor & Jankowiak, 2010). Males and females did not significantly differ in the amount of MVPA or number of steps accumulated, but those who met the physical activity guidelines accumulated significantly more steps than those who did not meet the physical activity guidelines (Raynor & Jankowiak, 2010).

Health Benefits of Different Recommendations

There are many ways to meet physical activity guidelines. Studies suggest that some recommendations have a greater impact than others on levels of physical activity. It is important to know whether different recommendations also produce different health benefits.

To compare the health benefits of continuous versus accumulated bouts of exercise, Murphy and colleagues (2009) completed a literature review of 16 training studies. In all studies, no subjects were meeting the current physical activity guidelines at the start of the study. Most of the interventions ranged in duration from 4 to 20 weeks and involved total daily exercise durations between 20 and 40 minutes on 3 to 5 days per week. Daily exercise was prescribed in 2, 3, or 4 bouts of 10-15 minutes for subjects assigned to accumulated exercise groups, with half of the studies requiring that bouts be separated by at least 2 hours. Findings from this review suggest that there is no difference between accumulated and continuous exercise of the same total duration on improvements in cardiovascular fitness, body composition, resting blood pressure, or metabolism of dietary fats.

Quinn and colleagues (2006) compared two 12-week aerobic exercise programs to determine whether exercising twice per day for 15 minutes (INT) would produce similar improvements in cardiovascular health and fitness compared with exercising once per day for 30 minutes (CON). Participants (n=37) were randomly divided into one of the two exercise groups. Throughout the study, participants visited the lab 7 times to complete treadmill walking tests, have blood samples taken, and have body composition measured. Weekly exercise was self-reported in exercise logs. Findings show that adults who exercised for two 15-min bouts per day achieved similar improvements in cardiovascular fitness as those who exercised once a day for 30 minutes.

Studies have found that similar health benefits are achieved with multiple shorter bouts of 10 to 15 minutes of exercise as with one long bout of exercise. However, intervention participants showed a smaller increase in MVPA when assigned to a bouts group versus a continuous exercise group (Samuels et al., 2011). It is unknown whether accumulating exercise in very short bouts of less than 10 minutes is beneficial.

Overall, health benefits are comparable across recommendations. Therefore, we may be able to focus on recommendations that are enjoyable and motivating to the individual, knowing that people should achieve similar health benefits regardless of the physical activity recommendation they adhere to.

Ways to Meet Physical Activity Guidelines

The physical activity guidelines set forth for the American public can be met in varying ways. Several studies have compared the effectiveness of recommending either 10,000 steps per day performed at a moderate-intensity pace, one continuous 30-minute bout of MVPA per day,

or multiple bouts of at least 10 minutes throughout the day to accumulate 30 minutes of MVPA daily. The impact of these recommendations on physical activity, self-efficacy, and health outcomes will be examined in the following sections.

Pace of Walking to Meet Guidelines

Walking is suitable to meet physical activity guidelines and, for some people, may be a more viable option compared to running or other higher-intensity activities. But, for walking to meet physical activity guidelines, we need to know how many steps are enough and at what step-rate walking is considered moderate-intensity.

To translate current recommendations for moderate-intensity physical activity into a pedometer-based step goal, Marshall and colleagues (2009) collected data from 97 volunteers (mean age 32) who participated in treadmill walking testing. Participants completed up to four 6-minute incremental walking bouts on a level treadmill while wearing a Yamax SW-200 pedometer to measure step-count and a face mask to collect expired air. The authors found that considerable error exists when using step count to measure Metabolic Equivalent for Tasks (METs). Findings suggest that only 15%-41% of the variance in METs could be explained by steps per minute and that walking intensity was correctly classified using step rate in only 50%-60% of individuals. However, these data support a general recommendation of walking at a cadence of at least 100 steps/minute to meet the minimum of the moderate-intensity guideline for accruing health benefits. Walking at least 3,000 steps in 30 minutes on 5 days per week, or three daily bouts of 1,000 steps in 10 minutes on 5 days per week equate to current recommendations for moderate-intensity physical activity. No differences in step count rate were found between genders. Thus, these guidelines are suitable for both men and women and these findings suggest that in order to receive health benefits from walking, steps must be taken at this cadence.

In order to update our knowledge of “How many steps/day are enough?”, Tudor-Locke and colleagues (2011) conducted a literature review of 837 articles dealing with step-defined human physical activity in healthy adults approximately 20-65 years of age. Moderate intensity walking is represented as 100 steps/minute. At this cadence, one would walk 3,000 steps in 30 minutes. Daily living physical activity that includes recommended MVPA equates to 7,100 to 11,000 steps/day. Thus, 10,000 steps/day is a reasonable target for healthy adults. Studies which employed a step goal (10,000 steps/day) had the greatest impact on physical activity increases and the use of pedometers increased physical activity by approximately 2,000 to 2,500 steps/day.

Overall, greater increases in activity have been seen in participants who are given a pedometer to monitor step-count and instructed to walk a specific number of steps per day as compared to those not given step-count goals (Baker et al., 2011; Hultquist et al., 2005; Pal et al., 2011). Several studies support the recommendation that walking should be performed at a cadence of at least 100 steps per minute to meet the moderate-intensity guideline (Marshall et al., 2009; Tudor-Locke et al., 2011). Further study is needed to examine the effectiveness of promoting the 3,000-steps-in-30-minutes recommendation.

Effectiveness of Recommendations for Increasing Physical Activity

One of our goals is to answer the question of how to most effectively increase amounts of physical activity. The following studies examine the impact of different physical activity recommendations to help determine which recommendations are most effective for increasing physical activity.

Samuels and colleagues (2011) examined the impact of three physical activity guidelines on physical activity levels and on self-efficacy. The guidelines included taking 10,000 steps per

day (10 K), engaging in 30-minutes of moderate intensity daily activity (30 min), and accumulating 30-minutes of moderate intensity physical activity in bouts of at least 10-minutes or longer on a daily basis (bouts). Participants (n=43) were given a sealed pedometer and an accelerometer and were divided equally among the 10 K, 30 min, and bouts groups. Participants in the 10 K group received unsealed pedometers so they could report their daily step count. Participants were encouraged to focus on meeting the physical activity guideline they were assigned and were told to keep an activity log. On average, participants in the 10 K group met their walking goal on 3.5 days per week, whereas those in the 30-min and bouts conditions met their goal on 2.8 and 2.3, respectively. Overall, the 10 K group showed the largest increase in step counts and the bouts group showed the lowest increase in step counts. Both the 10 K and 30 min group significantly increased their step counts during the intervention whereas the bouts group did not. The 10 K group had an increase of 5,583 steps compared to baseline. The 30-min group had an increase of 3,319 steps over baseline. The bouts group had an increase of 1,234 steps over baseline. The 10 K and 30 min groups had a large increase in MVPA; the 10 K group increased by 14 minutes and the 30 min group increased by 9.8 minutes. The bouts group experienced a small increase in MVPA of 1.9 minutes. Overall, the 10 K guideline resulted in the greatest increase in PA in the initial stages of activity adoption based on step count and MVPA. These findings suggest that activity guidelines have a greater impact on physical activity levels if they are aimed at step-count or one 30-minute bout of exercise compared to multiple shorter bouts of exercise.

Baker, Mutrie, and Lowry (2011) examined the use of pedometers during a 4-week walking intervention. Sixty-one participants, mean age 42.1 ± 10.6 years, completed the study. Participants followed one of three goal-setting programs: accumulate 3,000 additional steps

above baseline using a pedometer (PI) (n=21), accumulate 30 additional minutes of MVPA above baseline (MI) (n=21), or maintain baseline levels (control) (n=19) for four weeks. The PI and MI groups were given gradual goals (i.e. Week 1; increase step count by 1,500 steps/day on at least 3 days (PI) or walk an additional 15 minutes/day on at least 3 days (MI). Week 2; increase step count by 1,500 steps/day on at least 5 days (PI) or walk an additional 15 minutes/day on at least 5 days (MI).) Participants either received email support or no support. Steps were measured using the Omron HJ-104 Step-O-Meter and the Scottish Physical Activity Questionnaire was used to examine possible changes in overall physical activity. At 12 months, a follow-up was conducted in which participants wore a sealed pedometer for seven days and were asked to follow the same guidelines employed at baseline. Overall, participants in the PI group increased their mean daily step-count by 3,006 steps whereas the MI and control groups did not show any significant changes in step-count. At 12-months, participants in the PI group walked less than at week 4, but more than at baseline. Participants in the MI group maintained their self-reported minutes of physical activity. Email support had no effect. These findings suggest that people walk more when physical activity guidelines are given in terms of step-count rather than minutes.

Hultquist, Albright, and Thompson (2005) compared the daily number of steps over 4 weeks taken by 58 sedentary women (mean age 45 ± 6 years) who were randomly assigned to one of two groups: the 10K group (n=31) or the 30-min group (n=27). Baseline activity was measured for 14 consecutive days using the New Lifestyles NL-2000 sealed pedometers. Participants in the 10K group were instructed to walk 10,000 steps per day while those in the 30-min group were instructed to take a brisk 30-minute walk on preferably all days of the week. Participants in both groups wore the pedometer used at baseline. The 10K group also wore a

Yamax Digiwalker DW-200 which was not sealed. Findings show that those in the 10K group averaged 10,159 steps/day whereas those in the 30-min group averaged 8,270 steps/day. Both groups showed significant increases in step count overall. However, women accumulated more steps when given instructions to walk 10,000 steps/day versus being instructed to take a 30-minute walk. Therefore, these findings suggest that a physical activity goal focused on step-count would be more effective than a goal focused on the number of minutes spent walking.

Pal, Cheng, and Ho (2011) compared the effectiveness of recommending 10,000 steps per day versus recommending 30 minutes of walking per day in 28 women (age 45 ± 10 years). Participants were put into a 10,000 steps group or a 30-minutes group and their steps were measured with a pedometer over a 12-week period. The 30-minutes group were told they could achieve their 30 minutes of walking in one bout or in multiple shorter bouts of 10-15 minutes. The average number of steps per day were measured at baseline, week 6, and week 12 in both groups. The study found that women in both groups had an increase in daily steps, but those in the 10,000 steps group accumulated significantly more steps per day than the 30-minutes group. The 10,000 steps group also showed significant increases in their amount of walking at week 12 compared to baseline whereas the 30-minutes group did not. Therefore, this study suggests that a 10,000 steps/day goal would be more useful in promoting physical activity than a goal of walking for 30 minutes/day.

The studies previously discussed each focused on comparing the effectiveness of different physical activity recommendations. Overall, recommendations using step-count goals are more effective at increasing levels of physical activity than recommendations focused on spending a specific number of minutes being active. If recommendations are given in minutes, a single bout of 30-minutes is most effective for the promotion of physical activity.

Recommendations focused on a single bout of activity longer than 30 minutes or in multiple shorter bouts of activity seem to result in lower compliance and lower levels of accumulated physical activity.

The Combination Approach

Several studies have examined the influence of recommending either 10,000 steps per day, one continuous 30-minute bout of MVPA per day, or multiple bouts of at least 10 minutes throughout the day to accumulate 30 minutes of MVPA daily. A better approach for the recommendation of physical activity may be a combination of the 10,000 steps and 30-minutes of MVPA recommendations. A combination approach, to my knowledge, has yet to be examined or compared to other physical activity recommendations.

Outside of their 30-minutes of exercise, those who follow the 30-minutes of MVPA recommendation may be sitting during the majority of their waking hours. Sitting is associated with poor health, even if daily MVPA is reached (Ekelund et al., 2016). People working in jobs that require much sitting have about twice the rate of cardiovascular disease as those whose jobs allow more standing (Hamilton et al., 2007). Metabolic syndrome and type 2 diabetes have been shown to be directly related to sitting time, independent of exercise (Hamilton et al., 2007). A review by Biswas and colleagues (2015) showed that, regardless of physical activity, prolonged sitting was associated with deleterious health outcomes. However, studies show that MVPA may reduce, or at high levels even eliminate, the risk of mortality associated with sedentariness (Chau et al., 2013; Ekelund et al., 2016). Therefore, engaging in a 30-minute walk on most days of the week might still result in poor health outcomes.

Those who follow the 10,000 steps recommendation are likely more active throughout the day than those who follow the 30-minutes of MVPA recommendation. However, the walking recommendation is focused on behavior, not the metabolic cost of that behavior (Tudor-Locke & Bassett, 2004). The moderate-intensity guideline is only reached if walking is performed at a cadence of at least 100 steps per minute (Marshall et al., 2009; Tudor-Locke et al., 2011). Therefore, those who are encouraged to walk 10,000 steps per day could meet this goal but still might not be meeting current recommendations for MVPA.

Although they may be active throughout the day, people following the 10,000 steps recommendation may not be meeting the recommendation for engaging in moderate-to-vigorous physical activity. Similarly, those following the 30-minutes of MVPA recommendation might be sitting too much throughout the day even though they are meeting MVPA guidelines. Thus, a combination recommendation (encouraging 10,000 steps per day and a 30-minute bout of physical activity) may increase amounts of MVPA while simultaneously increasing activity throughout the whole day. This approach has the possibility to generate greater health outcomes than either the 10,000 steps or 30-minutes of MVPA approaches alone while attenuating the negative health consequences of sitting.

Social cognitive theory states that self-efficacy is an important factor in motivation, action, and personal change (Bandura, 2004). Therefore, social cognitive theory may play an important role in whether individuals adhere to the proposed recommendations for increasing physical activity.

Social Cognitive Theory

Social cognitive theory is composed of two premises: triadic reciprocal causation and personal agency (Bandura, 1999). Triadic reciprocal causation consists of behavior, environment, and social-cognitive factors and states that all psychosocial functioning within an individual is influenced by a bidirectional interaction between these three factors (Bandura, 1999). Bandura (1999) explains that people cannot control the environment around them but that personal attributes and behavior play a significant role in how they shape their own destiny.

Personal agency refers to the capacity to exercise control over one's own behavior and environment (Bandura, 2004). According to Bandura (2004), personal agency is developed through self-efficacy, outcome expectations, self-regulation of one's behavior, and having the necessary skills and abilities to change.

Self-Efficacy

Self-efficacy, the belief that one can successfully perform the desired behavior, plays a central role in personal change and is the foundation of motivation and action (Bandura, 2004). It influences goals, shapes outcome expectations, and determines how an individual views an obstacle (Bandura, 2004). Individuals with high self-efficacy are more likely to expect favorable outcomes and to view obstacles as something in which they can overcome (Bandura, 2004). Without the belief that one can produce the desired effects by their action, they have little reason to persevere in the face of difficulties (Bandura, 2004). Thus, a high level of self-efficacy increases motivation and enhances goal commitment by leading individuals to set higher goals and maintain a firmer commitment to those goals (Bandura, 2004; Locke & Latham, 2002). Self-efficacy is a strong predictor of energy expenditure and has been consistently shown to be a

predictor of the adoption and maintenance of physical activity behavior (Tavares et al., 2009; Williams & French, 2011).

Williams and colleagues (2008) conducted a study in which a 7-Day Physical Activity Recall (PAR) was administered at baseline, 6 months, and 12 months and psychosocial variables, including self-efficacy and enjoyment, were measured at 6 months in 205 participants. Their study showed that self-efficacy measured at 6-months was predictive of physical activity maintenance at 12-months and that self-efficacy and enjoyment are important for physical activity maintenance (Williams et al., 2008).

Samuels and colleagues (2011) measured self-efficacy multiple times throughout their study to examine the impact of three physical activity guidelines on physical activity levels and on self-efficacy. A 15-item PA self-efficacy scale administered at baseline, week 1, and week 4 revealed a decrease in self-efficacy in all three groups (10 K, 30 min, and bouts). Although self-efficacy was related to physical activity levels, physical activity levels increased in all groups from baseline to week 4. This study suggests that interventions should target self-efficacy and that raising self-efficacy may result in greater behavioral change (Samuels et al., 2011).

Jones and colleagues (2005) looked at the role of outcome expectations and self-efficacy in adherence to a gym based exercise prescription. Participants were men and women who were referred by their medical practitioner for a course of exercise. Participants completed questionnaires which measured exercise self-efficacy and outcome expectations at baseline and again at the end of 24 exercise sessions. At the start of the study, participants had a low level of physical fitness but were confident in their ability to maintain a regular exercise schedule and had high outcome expectations of benefits. Those with higher initial outcome expectations of change ended up dropping out of the exercise program and those who did not drop out of the

program had improved self-efficacy. These findings suggest that high expectations may lead to disappointment and lowered self-efficacy whereas realistic outcome expectations may increase success and raise self-efficacy (Jones et al., 2005).

Self-efficacy can be raised through the use of mastery experiences (experiencing success with a task), vicarious experiences (observing the behavior of others), verbal persuasion (specific and meaningful information communicating a person can succeed), positive interpretations of physiological states, action planning and goal setting (when, where, and how a specific behavior will be performed), reinforcement of effort or progress, and instruction (Bandura, 2004; Williams & French, 2011). If we can increase self-efficacy for meeting physical activity recommendations, then people will be more likely to adopt and maintain increased physical activity behavior.

Goal Setting

Setting goals is helpful in guiding people to meet physical activity guidelines. Locke & Latham (2002) use their goal-setting theory to explain that goals are closely related to performance and behaviors and that goals affect performance through four mechanisms: clarity, challenge, commitment, and strategy. Clarity and challenge refer to specific, moderately difficult goals which lead to higher performance than when people are either urged to do their best or when the task is too easy or too difficult (Locke & Latham, 2002). Goals affect action indirectly by leading to the discovery and use of task-relevant knowledge and strategies (Locke & Latham, 2002).

When setting goals, it is sometimes necessary to set learning goals first rather than specific performance goals (Locke & Latham, 2006). This goal setting method allows a person to focus on acquiring the skills necessary to their overall goal (Locke & Latham, 2006).

McEwan and colleagues (2016) conducted a systematic review and meta-analysis of goal-setting interventions for changing physical activity behavior. It was found that goal setting interventions are effective for improving physical activity, especially when the individual chooses the goals they set for themselves (McEwan et al., 2016). Goal setting is most effective when goals are set specifically for aerobic activities or more generally for any type of activity the individual wishes to participate in (McEwan et al., 2016). Furthermore, a goal which targets a moderate intensity and/or emphasizes daily physical activity will be more effective than a goal which targets high or low intensity or weekly physical activity (McEwan et al., 2016). Goals emphasizing a combination of daily and weekly physical activity have also been found to be more effective than emphasizing weekly activity alone (McEwan et al., 2016). In one study, goals which focused on meeting or exceeding public health recommendations for physical activity resulted in a 20% increase in the proportion of participants who were physically active (Dishman et al., 2009).

Goals can be set as long-term or short-term. Long-term goals set the course of personal change but, because of other influences, do not control a person's current behavior (Bandura, 2004). Attainable, short-term goals are needed to help people succeed because they encourage current effort and action (Bandura, 2004).

A key factor for increasing and sustaining physical activity levels is self-regulatory skills ("Identifying priorities among goals and plans", 2012). Self-regulatory skills are components of social cognitive theory (Amaya & Petosa, 2012) and include goal setting, planning and

scheduling, and prioritization (“Identifying priorities among goals and plans”, 2012). It has been shown that individuals with better self-regulatory skills have higher self-efficacy, hold more positive views of physical activity, and report more physical activity than those without these skills (“Identifying priorities among goals and plans”, 2012).

Self-efficacy, goal-setting, and enjoyment interrelate to influence physical activity behavior. When individuals set goals for themselves in addition to having high levels of exercise self-efficacy and exercise enjoyment, physical activity is more likely to be adopted and maintained (Hu et al., 2007; Locke & Latham, 2002; Tavares et al., 2009). SCT explained almost one-third of the variance in physical activity behavior, with self-efficacy and goal-setting being consistently and positively associated with physical activity behavior (Young et al., 2014). Young and colleagues (2014) found that outcome expectations and socio-structural factors were not associated with physical activity behavior.

Enjoyment

Enjoyment is an important facilitator of physical activity within SCT. Enjoyment, self-efficacy, outcome expectations, goal-setting, and self-regulation interrelate to influence physical activity behavior. Thus, enjoyment is important in the adoption and maintenance of physical activity. When an individual experiences enjoyment or expects to experience enjoyment from physical activity, he or she is more likely to adopt and maintain physical activity behaviors.

It has been shown that high self-efficacy significantly influences levels of enjoyment (Hu et al., 2007). Hu and colleagues (2007) conducted a study to examine exercise self-efficacy on enjoyment of physical activity. In their study, participants completed a self-efficacy assessment regarding moderate to hard intensity cycling, engaged in a cycling exercise session, and then

completed the Physical Activity Enjoyment Scale (PACES) (Hu et al., 2007). Hu and colleagues (2007) found that participants with high self-efficacy also reported greater enjoyment in physical activity.

Lewis and colleagues (2016) conducted a study to examine how self-efficacy and enjoyment relate to influence physical activity behavior. Participants were assigned to a motivational physical activity intervention and completed measures of enjoyment (PACES) and self-efficacy (Lewis et al., 2016). Results indicated that enjoyment and self-efficacy both influence physical activity behavior, but that enjoyment is a greater influence on physical activity behavior than is self-efficacy (Lewis et al., 2016).

To examine the effect of enjoyment of physical activity on the efficacy of physical activity interventions, Williams and colleagues (2006) conducted a study in which participants' (n=238) levels of enjoyment and MVPA were examined. Participants were randomized into physical activity intervention groups and completed the PACES and the 7-Day PAR at baseline and 6 months (Williams et al., 2006). Results indicated that the physical activity intervention showed greater efficacy for participants with higher levels of perceived enjoyment at baseline (Williams et al., 2006). Significant increases in MVPA were achieved by participants with higher baseline levels of perceived enjoyment, but not by participants reporting lower levels of baseline enjoyment (Williams et al., 2006).

Enjoyment is predictive of physical activity maintenance (Williams et al., 2008). To examine the relationship between enjoyment of exercise and exercise level, Hagberg and colleagues (2009) conducted a study in which participants took part in an intervention aimed at increasing exercise. Enjoyment of exercise and exercise level were measured throughout the 12-month intervention (Hagberg et al., 2009). Results indicated that enjoyment is an important

component of physical activity adherence and that increasing exercise enjoyment may contribute to long-term adherence to physical activity (Hagberg et al., 2009).

Along with its contribution to long-term adherence to physical activity, an individual's level of enjoyment during physical activity influences the amount of time spent being physically active (Dishman et al., 2005). Dishman and colleagues (2005) conducted a study in which enjoyment was measured over the course of an intervention aimed at increasing physical activity. Their findings indicate that increased enjoyment results in increased physical activity (Dishman et al., 2005).

Bryant, Cosgrove, and Shangguan (2014) surveyed 374 university students regarding their levels of physical activity during the previous 3 months and measured their physical activity enjoyment level using the PACES. A significant correlation was found between enjoyment of exercise and physical activity levels as well as between self-efficacy and physical activity levels (Bryant et al., 2014).

It is known that regular physical activity has positive health benefits and that sedentariness increases the risk of obesity, certain cancers, cardiovascular disease, mental health problems, and premature death (Tremblay et al., 2010). However, a small percentage of the population actually achieves physical activity recommendations (Schoenborn & Stommel, 2011). Current physical activity recommendations encourage taking 10,000 steps per day or engaging in 30-minutes of moderate-to-vigorous physical activity and step-count goals using pedometers have been found to be the most effective method for increasing levels of physical activity. However, the impact of a combination of the current recommendations on physical activity levels, self-efficacy, and enjoyment has yet to be examined; therefore, conducting a study which focuses on this combination approach is necessary.

CHAPTER 3: METHODS

Design

This study focuses on meeting physical activity recommendations and aims to determine the impact of three different physical activity guidelines on physical activity, self-efficacy and enjoyment. This study also examines the relationships among self-efficacy, enjoyment, step-count, and minutes of MVPA at T1 and T2. This study used a randomized design with four groups: steps, minutes, combination, and control. The study consisted of a 1-week baseline, 4-week intervention, and post-intervention testing that occurred during the final week of the 4-week intervention. *Figure 1* illustrates the flow of participants through the study. As an incentive to complete the study, participants had several opportunities throughout the study to be entered into a raffle to win one of four \$50 gift cards or one of five Omron pedometers. These opportunities were contingent on completion of questionnaires, requested visits to the research lab, and submitting activity logs. For each step of the study that was completed (i.e., completing a questionnaire, visit to the lab, submitting activity log), the participant's name was entered into the raffle. There were a total of 9 opportunities for participants to earn an entry in the raffle.

Sample Size

G*Power 3.1.9.2 power analysis program (Faul et al., 2007) was used to calculate an a priori sample size that would be required to achieve a statistical power of 0.80. Based on an alpha of 0.05, a moderate correlation among repeated measures (0.60), and the expectation of a medium effect size (0.25), a sample size of 40 was calculated based on four groups and two time points. To account for participants who may not complete the study, we planned to recruit ~60-72 participants to yield ~15-18 participants per group.

Participants

After Institutional Review Board approval, participants were recruited via flyers, a university listserv, and a city listserv inviting people aged 18-64 years whom, at the time of the study, were not currently meeting physical activity guidelines, interested in increasing their physical activity, and healthy enough to participate in physical activity. To determine whether a participant was healthy enough to participate in physical activity, Physical Activity Readiness Questionnaires (PAR-Q) were administered. The PAR-Q includes seven questions related to heart conditions, chest pain, dizziness, blood pressure, and bone and joint problems such as “Do you feel pain in your chest when you perform physical activity?” and “Do you have a bone or joint problem that could be made worse by a change in your physical activity?” If an individual answered “no” to all questions in the PAR-Q, he or she was eligible to participate in this study. If an individual answered “yes” to only one question in the PAR-Q, medical clearance was required for participation in this study. If an individual answered “yes” to more than one question in the PAR-Q, the individual was not eligible to participate. Flyers were posted throughout a university campus. Phone calls were made to those who expressed interest in the study to provide more information. The PAR-Qs were administered over the phone to determine participation eligibility. All participants who were qualified were scheduled for a baseline testing session.

Procedures

At the baseline testing session, participants signed an informed consent document, completed a demographic questionnaire, and completed height and weight measurements. Participants then received instructions for wearing a sealed pedometer and an accelerometer for the next 7 days. Participants were asked to wear the activity monitors during all waking hours while engaging in their normal daily activities without any modifications. After wearing the

activity monitors for one week for baseline testing, participants completed questionnaires assessing exercise self-efficacy and exercise enjoyment. Questionnaires assessing exercise self-efficacy and exercise enjoyment were administered again after week 1 and after week 4. All baseline measurements were repeated during post-intervention testing along with additional debriefing questions. The debriefing questionnaire was administered in person during the participant's final visit.

After one week of wearing the activity monitors, participants returned to the lab to return the accelerometers and allow the study staff to retrieve the pedometer data from the device's memory. The pedometers were returned to all participants unsealed to wear for the remainder of the study.

Immediately following their second visit to the lab, participants were placed into matched pairs by age, sex, and baseline physical activity (determined by baseline pedometer steps) and randomly assigned to one of the three intervention groups (i.e., step-count, 30-min MVPA, combination) or the control group using a random number sequence. The random number was used to assign the first member of the pair into a group and then the second member was automatically placed in the alternate group. Participants were informed of their physical activity goal by email and were instructed to follow their group's physical activity goal for four weeks. Participants in the intervention groups were emailed physical activity logs corresponding to their physical activity goals. Participants were instructed to update their physical activity logs daily and enter the information from their logs into a survey on Qualtrics at the end of each week. See Appendix F for samples of the physical activity guideline email templates sent to each group.

At the end of week 3, participants returned to the lab to pick up accelerometers which were worn during week 4 in addition to the pedometers. Individual weekly email reminders were

sent each Sunday to remind participants to record their weekly activity on Qualtrics and to remind them of their physical activity goals for the upcoming week.

Intervention

Each of the intervention groups followed a graduated goal program in which their walking goals increased weekly. This graduated walking program was found to be successful in promoting significant increases in pedometer-measured walking over a 4-week period (Baker et al., 2008). The overall goals for each group were to accumulate 10,000 steps daily (steps), 30 minutes of physical activity on at least five days per week (minutes), or accumulate 10,000 steps daily and 30 minutes of physical activity on at least five days per week (combo). Participants were also told that surpassing physical activity goals leads to positive health benefits and increasing physical activity, even if not meeting goals, is associated with positive health outcomes (Tremblay et al., 2010). Participants were instructed that they could choose continuous activity or multiple shorter bouts of activity throughout the day. Each participant received individualized goals based on their baseline data that moved them towards the overall goal for their group. Participants in the control group were informed of the 150-minute recommendation set forth by the U.S. Department of Health and Human Services. Control group participants were asked to wear a pedometer but were not asked to track or record their physical activity. ***Table 1*** displays the weekly physical activity guidelines for each group.

Table 1. Weekly Physical Activity Guidelines

	Step-Count Group	Minutes Group	Combination Group	Control Group
Week 1	Increase baseline daily step-count by 1,500 steps/day on at least 3 days/week	Accumulate an additional 15 minutes/day of MVPA on at least 3 days of the week	Increase baseline daily step-count by 1,500 steps/day on at least 3 days/week AND accumulate an additional 15 minutes/day of MVPA on at least 3 days of the week	Informed of 150-minute recommendation and asked to wear a pedometer but were not asked to track or record activity
Week 2	Increase baseline daily step-count by 1,500 steps/day on at least 5 days of the week	Accumulate an additional 15 minutes/day of MVPA on at least 5 days of the week	Increase baseline daily step-count by 1,500 steps/day on at least 5 days of the week AND accumulate an additional 15 minutes/day of MVPA on at least 5 days of the week	Informed of 150-minute recommendation and asked to wear a pedometer but were not asked to track or record activity
Week 3	Increase baseline daily step-count by 3,000 steps/day on at least 3 days of the week	Accumulate an additional 30 minutes/day of MVPA on at least 3 days of the week	Increase baseline daily step-count by 3,000 steps/day on at least 3 days of the week AND accumulate an additional 30 minutes/day of MVPA on at least 3 days of the week	Informed of 150-minute recommendation and asked to wear a pedometer but were not asked to track or record activity
Week 4	Increase baseline daily step-count by 3,000 steps/day on at least 5 days of the week	Accumulate an additional 30 minutes/day of MVPA on at least 5 days of the week	Increase baseline daily step-count by 3,000 steps/day on at least 5 days of the week AND accumulate an additional 30 minutes/day of MVPA on at least 5 days of the week	Informed of 150-minute recommendation and asked to wear a pedometer but were not asked to track or record activity

Measures

Demographics

At the baseline testing session, participants were instructed to complete a demographic and health information questionnaire. The 31-item questionnaire consisted of questions regarding participant age, education, employment, marital status, and family health status. Answer choices were provided for all questions except those asking about the participant's type of employment, age and sex of the participant's children, and those which required a numeric answer.

Self-monitoring

Participants in all groups received instant feedback through the use of the pedometer which encourages self-monitoring. To further encourage active self-monitoring, intervention condition participants were instructed to maintain an activity log which was supplied and corresponded to their activity recommendation. All of the activity logs were fill-in the blank tables that, for each day of the intervention, included wear time (start and end time), number of steps taken (steps group), number of activity minutes (minutes group), number of steps taken and activity minutes (combination group), and a place for additional comments where participants were instructed to write down any times that the pedometer was removed during the day. At the end of each week, participants were asked to enter the data from their activity logs into a survey on Qualtrics. A weekly email was sent to remind participants to enter their data into Qualtrics. See Appendix E for the activity logs used for each group.

Self-efficacy

Participants' physical activity self-efficacy was measured using a 6-item exercise self-efficacy scale modified from Hu et al., 2007. The scale used in the current study was modified to

reflect the physical activity goal for each group and it evaluated the individual's belief in his/her ability to meet the physical activity recommendations for their assigned group for 5 days out of the week each week for the next eight weeks. Participants rated their confidence to meet their activity recommendation using a scale ranging from 0% to 100%. Sample items included "I am able to participate in physical activity on 5 days of the week at moderate intensity, for 30 minutes or more without quitting for the NEXT WEEK"; "I am able to accumulate 10,000 steps or more for 5 days of the week without quitting for the NEXT 2 WEEKS"; "I am able to participate in physical activity for 5 days of the week at moderate intensity to accumulate 150 minutes of physical activity per week without quitting for the NEXT THREE WEEKS". To test reliability and internal consistency of this scale, Cronbach's alpha values were computed. Reliability analysis demonstrated that the Exercise Self Efficacy Scale was a reliable measure of self-efficacy across all groups and time points (T1, $\alpha = .988$; W1, $\alpha = .992$; T2 $\alpha = .997$). See Appendix D for the complete exercise self-efficacy questionnaires used for each group.

Enjoyment

Participants' physical activity enjoyment was measured using a short version of the Physical Activity Enjoyment Scale (PACES) (Kendzierski & DeCarlo, 1991; Raedeke & Amorose, 2013). This version of the PACES is an 8-item scale in which participants rated their feelings using a 7-point bipolar scale based on the instruction "rate how you feel *at the moment* about the physical activity you have been doing." Sample items included "I enjoyed it ... I hated it"; "It was very pleasant ... It was very unpleasant"; "I was very absorbed in the activity ... I was not at all absorbed in the activity". When scoring the PACES, some items were reverse-scored so that high scores indicate high enjoyment. To test reliability and internal consistency of the PACES, Cronbach's alpha values were computed. Reliability analysis demonstrated that the

PACES was a reliable measure of enjoyment across all time points (T1, $\alpha = .937$; W1, $\alpha = .930$; T2 $\alpha = .970$). See Appendix D for the 8-item PACES.

Pedometers

New Lifestyles (NL)-1000 pedometers were used. Participants were instructed to wear the pedometers on their right hip during all waking hours except for when showering or swimming. The NL-1000 provides the option to display either steps or activity minutes so all participants had the opportunity to receive instant feedback relative to their given activity guidelines, regardless of their condition group.

Accelerometers

The Actigraph GT3x accelerometer was used as a second measure of physical activity to calculate the amount of time spent in MVPA. Pedometers estimate activity minutes through step-count, but they do not provide activity intensity categories whereas the accelerometers do. Data were recorded in one-minute epochs and time spent in MVPA was based on application of count thresholds (Freedson, et al., 1998).

Debriefing

At the end of week 4, a debriefing questionnaire was administered to participants as part of the post-intervention questionnaire packet. This questionnaire served to determine to what extent participants focused on their goals and how often participants checked their pedometers for steps, activity minutes, or both. Sample items included “To what extent did you focus on meeting a step-count goal during this study?”; “Did you check your pedometer for activity minutes, step counts, or both?”; “How often did you check your pedometer for activity

minutes?’. Participants were also asked whether or not they knew any other study participants and other participants’ goals. See Appendix D for the complete debriefing questionnaire.

Height and weight

Height (cm) and weight (kg) were measured by a trained research assistant using a portable stadiometer (Seca 213) and scale (Seca 876).

Statistical Analysis

Using data collected from both pedometers and accelerometers, a series of repeated measures ANOVAs were conducted to examine whether participants in each group differed across the 4-week study period on (a) the number of days they met their walking recommendation, (b) overall accelerometer-measured step counts, (c) step counts on days goals were met and unmet, (d) accelerometer-measured minutes of MVPA, (e) self-efficacy, and (f) enjoyment. Effect sizes (Cohen’s *d*) were calculated to compare differences between each group. Frequency data were evaluated to determine how many participants from each group increased their step-count during the course of the intervention. Lastly, correlations between step-count and change in self-efficacy, and correlations between step-count and change in enjoyment were conducted.

CHAPTER 4: RESULTS

Participants

As shown in *Figure 1*, 111 individuals expressed interest in participating in this study. Of the 111 individuals who were interested, 61 did not respond to the study description email and 50 were assessed for eligibility. Of the 50 individuals who were assessed for eligibility, 42 met inclusion criteria and were randomized into groups. Two participants dropped out before the end of the study due to time commitment issues. One of these participants was included in an intention-to-treat analysis. The other drop-out was not included in the intention-to-treat analysis because no data had been collected before the participant dropped out. Participants were aged 45.95 ± 11.46 years and had a BMI of $28.62 \pm 6.33 \text{ kg/m}^2$. Most participants were female ($n=36$, 85.7%) and were classified as either “overweight” or “obese” ($n=29$, 69%), and 28.6% ($n=12$) fell into the normal weight category. Complete demographic information is displayed in *Table 2*.

In addition to one of the drop-outs, participants were included in the intention-to-treat analysis if they completed the intervention but did not provide complete data throughout the study. Included in the intention-to-treat analysis for T2 variables were two participants for step count, two participants for minutes of MVPA, six participants for self-efficacy, and six participants for enjoyment.

Figure 1. Steps and procedures

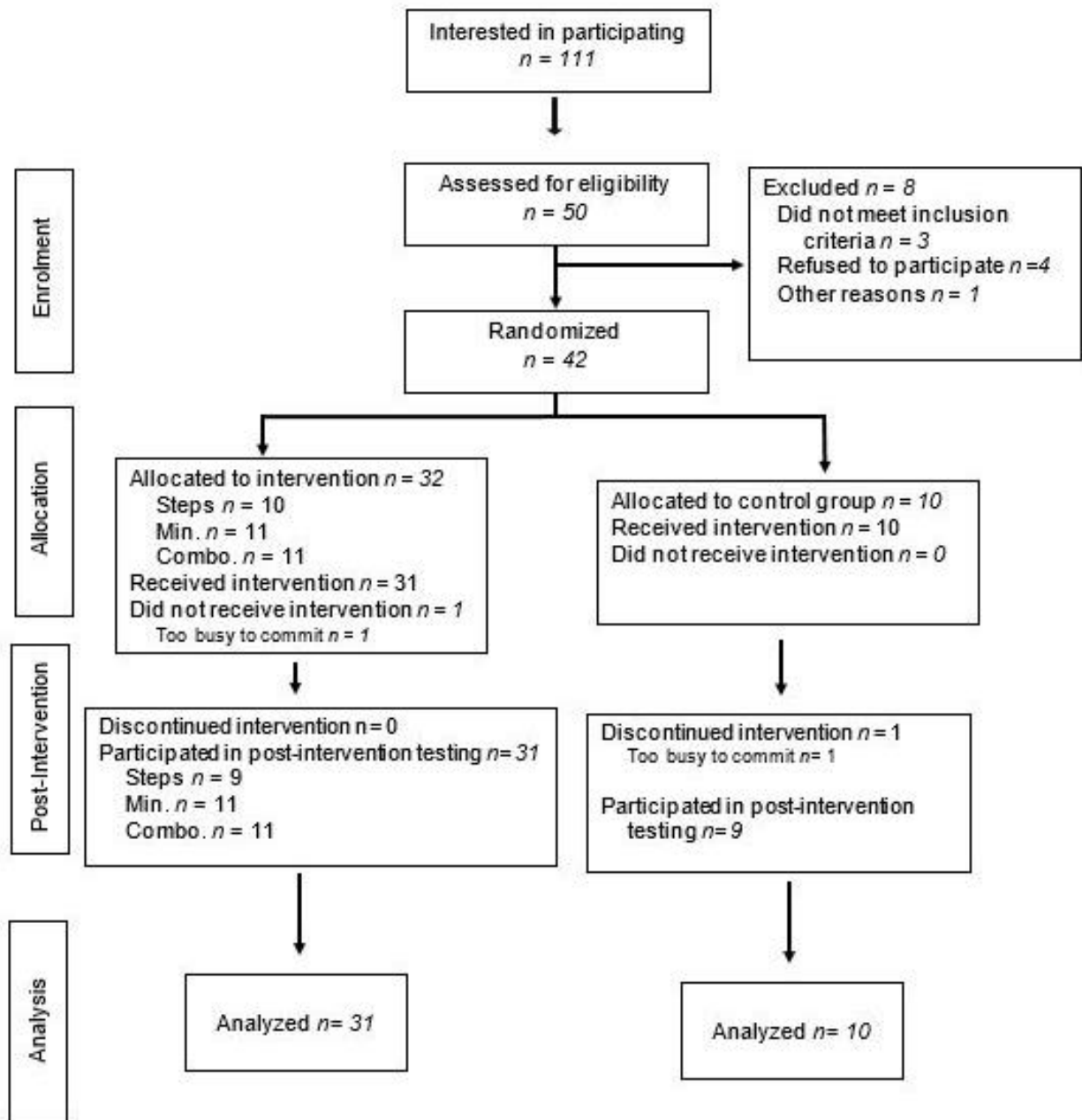


Table 2. Demographic information, overall and by group.

		Overall	Steps group	Minutes group	Combination group	Control group
Age (years)	M (SD)	45.95 (11.46)	40.8 (11.49)	49.18 (9.74)	46.36 (12.28)	47.10 (12.22)
Sex (n)	Female Male	36 (85.7%) 6 (14.3%)	8 (80%) 2 (20%)	10 (90.9%) 1 (9.1%)	9 (81.8%) 2 (18.2%)	9 (90%) 1 (10%)
Race (n)	African American Non-Hispanic White Hispanic Asian Native American	9 (21.4%) 30 (71.4%) 1 (2.4%) 1 (2.4%) 1 (2.4%)	3 (30%) 6 (60%) 1 (10%) 0 0	2 (18.2%) 9 (81.8%) 0 0 0	0 9 (81.8%) 0 1 (9.1%) 1 (9.1%)	4 (40%) 6 (60%) 0 0 0
Income (n)	< \$15,999 \$16,000 to \$24,999 \$25,000 to \$34,999 \$35,000 to \$49,999 \$50,000 to \$74,999 \$75,000 and greater Don't know/refused	1 (2.4%) 2 (4.8%) 5 (11.9%) 4 (9.5%) 13 (31%) 13 (31%) 4 (9.5%)	1 (10%) 1 (10%) 0 0 4 (40%) 3 (30%) 1 (10%)	0 0 0 1 (9.1%) 3 (27.3%) 4 (36.4%) 3 (27.3%)	0 1 (9.1%) 4 (36.4%) 0 4 (36.4%) 2 (18.2%) 0	0 0 1 (10%) 3 (30%) 2 (20%) 4 (40%) 0
Education (n)	High school Some College Bachelor's Degree Graduate Degree	1 (2.4%) 9 (21.4%) 16 (38%) 16 (38%)	0 1 (10%) 4 (40%) 5 (50%)	0 2 (18.2%) 5 (45.5%) 4 (36.4%)	0 4 (36.4%) 5 (45.5%) 2 (18.2%)	1 (10%) 2 (20%) 2 (20%) 5 (50%)
BMI (T1)	M (SD)	28.62 (6.33)	27.52 (5.22)	27.13 (7.96)	29.08 (5.60)	30.86 (5.91)

Physical Activity

Table 3 displays the means and standard deviations of daily step counts and minutes spent in MVPA for all groups at T1 and T2 and on days in which goals were met and not met. A series of repeated measures ANOVAs were conducted with average daily step count and minutes spent in MVPA set as the dependent variables. All variables are based on an intent to treat analysis with the last value carried forward. Participants were compared on their accelerometer measured daily average step counts and daily average minutes spent in MVPA at T1 and T2. The time main effect was non-statistically significant for step counts [$F(1, 37) = .02, p = .89$] and minutes of MVPA [$F(1, 37) = .26, p = .61$]. There were no statistically significant group (steps, minutes, combo, control) by time (T1 and T2) interaction for step counts [$F(3, 37) = 2.07, p =$

.12] or minutes of MVPA [$F(3, 37) = 1.39, p = .26$]. There were no significant differences ($p > .05$) found within groups from T1 to T2. Effect size calculations showed a small increase in step counts from T1 to T2 in the steps group ($d = 0.27$), the minutes group ($d = 0.24$), and the combination group ($d = 0.24$), and a large decrease in the control group ($d = -0.88$). Effect size calculations showed a medium difference in minutes of MVPA from T1 to T2 in the minutes group ($d = 0.50$) and the control group ($d = -0.36$), whereas effect size calculations for the steps group and the combination group showed no change ($d = -0.005$) and ($d = 0.04$), respectively. Effect sizes are included in **Table 3**. Overall, the minutes group showed the largest increase in minutes spent in MVPA over the course of the intervention, and all three intervention groups had similar increases in step counts. The control group experienced a decrease in both step count and minutes spent in MVPA from T1 to T2. The average number of steps walked at T1 for participants in the intervention groups and the control group were $6,634 \pm 1,545$ and $6,745 \pm 1,107$, respectively. At T2, participants in the intervention groups and the control group walked an average of $7,044 \pm 2,163$ and $5,327 \pm 2,102$, respectively. The average number of minutes spent in MVPA at T1 for participants in the intervention groups and the control group were 13.25 ± 7.57 and 9.46 ± 5.38 , respectively. At T2, participants in the intervention groups and the control group spent an average of 14.73 ± 8.97 and 7.34 ± 6.37 minutes in MVPA, respectively. **Figure 2** and **Figure 3** illustrate changes in pedometer measured step count and MVPA from T1 to T2 for all intervention groups.

Using a one-way ANOVA, the three intervention groups were compared on days in which they met their goal. No significant interaction was identified between groups, [$F(2) = .88, p = .43$]. Out of 28 possible days over the course of the 4-week intervention period, participants in the steps group and minutes group met their goals on 8.7 ± 5.7 days and 11.5 ± 7.8 days,

respectively, and those in the combination group met their goal on 7.7 ± 5.9 days. Overall, participants walked an average of $11,796 \pm 2,518$ steps on days in which physical activity goals were met and an average of $6,787 \pm 2,174$ steps on days in which goals were not met. Participants averaged 52.6 ± 10.7 minutes of MVPA on days in which physical activity goals were met and 22.3 ± 9.2 minutes of MVPA on days in which goals were not met.

Table 3.

Accelerometer-measured daily step counts and MVPA for all groups across the study period.

Daily Step Count (M \pm SD)					
	T1	T2	On Days Goals Were Met	On Days Goals Were Not Met	Effect size (d) for T1 to T2
Steps group	6,457 \pm 1,146	6,732 \pm 2,087	10,765 \pm 2,131	5,858 \pm 1,725	0.27
Minutes group	6,581 \pm 1,658	7,098 \pm 2,649	-	-	0.24
Combination group	6,863 \pm 1,831	7,302 \pm 1,754	12,828 \pm 2,557	7,715 \pm 2,264	0.24
Control group	6,745 \pm 1,107	5,327 \pm 2,102	-	-	-0.88

Daily Minutes of MVPA (M \pm SD)					
	T1	T2	On Days Goals Were Met	On Days Goals Were Not Met	Effect size (d) for T1 to T2
Steps group	13.81 \pm 7.90	13.77 \pm 9.24	-	-	-0.005
Minutes group	11.34 \pm 6.00	15.47 \pm 10.47	50.25 \pm 10.33	20.52 \pm 10.05	0.50
Combination group	14.61 \pm 8.81	14.94 \pm 7.20	55.22 \pm 11.15	24.33 \pm 8.35	0.04
Control group	9.46 \pm 5.38	7.34 \pm 6.37	-	-	-0.36

Figure 2. Changes in pedometer-measured step count across the study period.

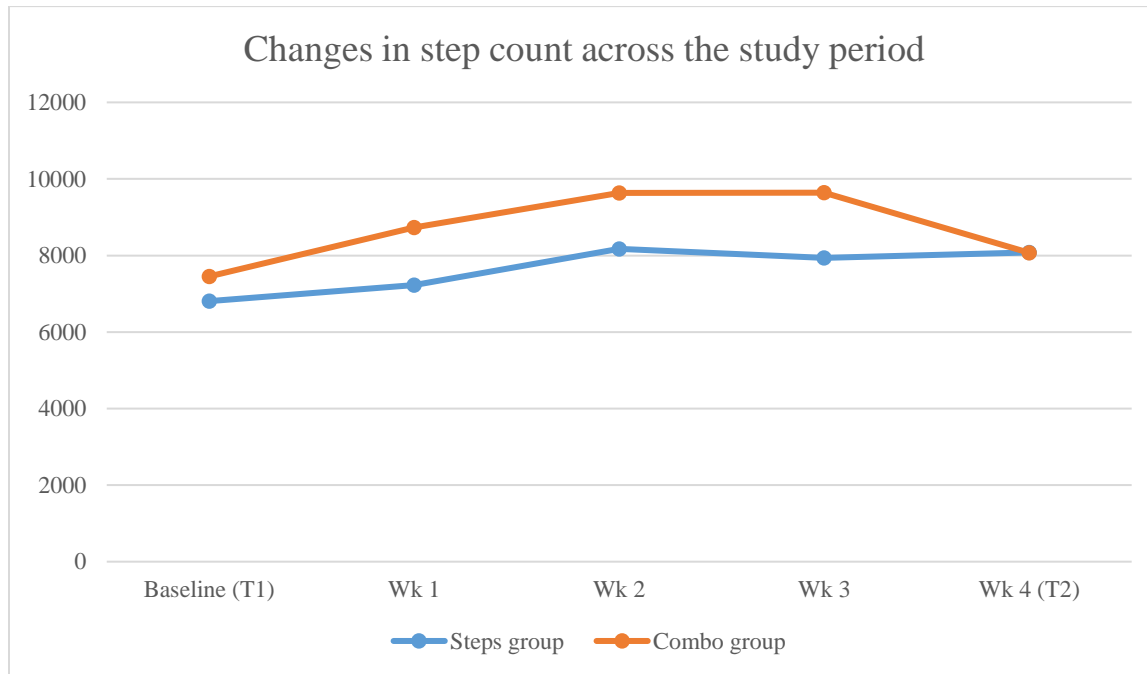
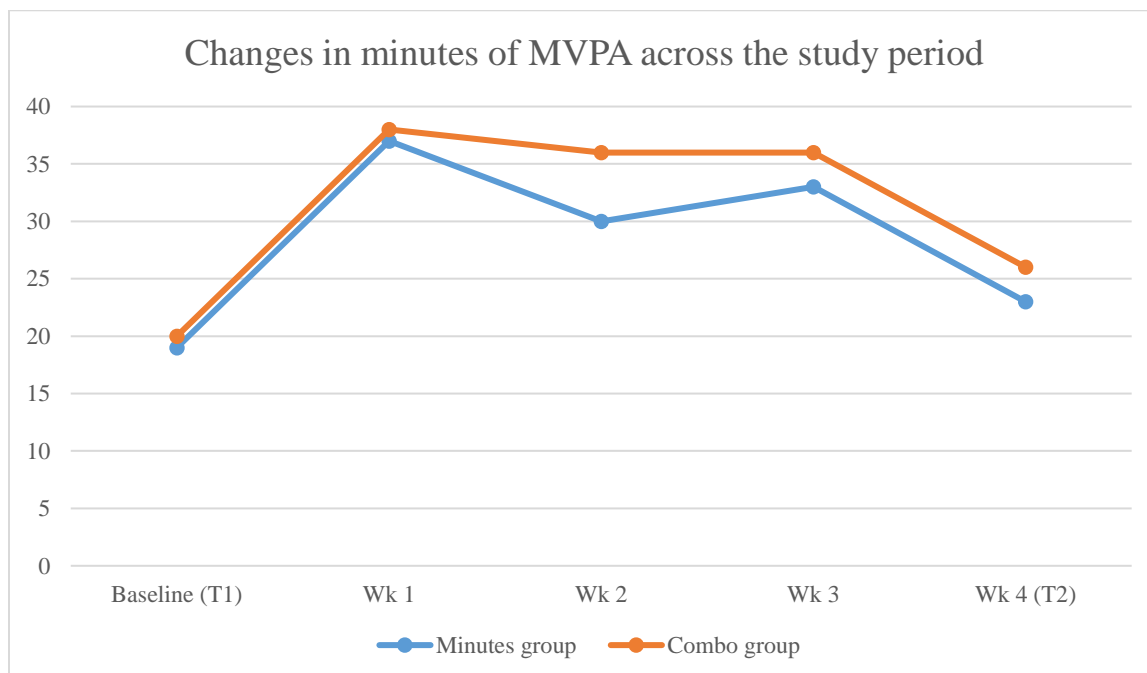


Figure 3. Changes in pedometer-measured minutes of MVPA across the study period.



Frequency data were evaluated to determine the number of participants in each group who increased their accelerometer measured step-count from T1 to T2. Intention-to-treat variables were used in this analysis for four participants. Overall, the number of participants who showed increases in step-count from T1 to T2 ($n = 19$) was equal to the number of participants who showed decreases in step-count from T1 to T2 ($n = 19$). More participants from the minutes group increased step-counts from T1 to T2 ($n=6$) compared to the other groups. Five participants from both the steps group and the combination group, and three participants from the control group increased their step-count from T1 to T2. **Table 4** displays the number of participants in each group who increased their step-count from T1 to T2. For comparison, the number of participants in each group who increased their minutes of MVPA from T1 to T2 is included in the table.

Table 4. Number of participants in each group who increased or decreased their accelerometer-measured step-count and minutes of MVPA from T1 to T2.

Participants (n)		Increase		Decrease	
		Step- Count	Min. MVPA	Step- Count	Min. MVPA
	Steps group	5	3	3	6
	Minutes group	6	8	4	2
	Combination group	5	4	6	6
	Control group	3	3	6	6

Self-Efficacy

Self-efficacy was measured using the Exercise Self Efficacy Scale. To examine the impact of each of the physical activity recommendations on self-efficacy, a repeated measures ANOVA was used to compare self-efficacy between the groups at T1 and T2. No significant interaction was identified between groups and time, [$F(3, 34) = .63, p = .60$]. On average, at T1, participants in the intervention groups rated themselves as $75\% \pm 23\%$ confident that they could meet walking goals specific for their groups. Participants in the control group rated themselves as $82\% \pm 19\%$ confident in their ability to meet general physical activity recommendations. At T2, participants in the interventions groups and the control group rated their confidence levels for meeting activity guidelines as $62\% \pm 28\%$ and $40\% \pm 21\%$, respectively. None of the groups reported an increase in self-efficacy from T1 to T2. Based on effect size calculations, the combination group reported a larger decrease in self-efficacy than the minutes group, and the minutes group reported a larger decrease in self-efficacy than the steps group. The control group reported the largest decrease in self-efficacy overall. Effect size calculations revealed that the minutes group, combination group, and control group all had large decreases in self-efficacy from T1 to T2 ($d = -0.60$; $d = -0.58$; $d = -2.1$), respectively. The steps group had a medium decline in self-efficacy from T1 to T2 ($d = -0.23$). **Table 5** displays confidence levels reported by group at T1, W1, and T2.

Table 5. Average confidence levels reported by group at T1, W1, and T2.

	T1 (M ± SD)	W1 (M ± SD)	T2 (M ± SD)	Effect Size (d) for T1 and T2
Steps group	77% ± 16%	74% ± 23%	73% ± 19%	-0.23
Minutes group	68% ± 24%	58% ± 32%	51% ± 33%	-0.60
Combination group	80% ± 29%	60% ± 38%	62% ± 33%	-0.58
Control group	82% ± 19%	55% ± 25%	40% ± 21%	-2.1

Enjoyment

Physical activity enjoyment was measured using the PACES. To examine the impact of each of the physical activity recommendations on enjoyment, a repeated measures ANOVA was used to compare enjoyment between the groups at T1 and T2. No significant interaction was identified between groups and time, [$F(3, 36) = .51, p = .68$]. At T1, participants in the intervention groups scored an average of 4.72 ± 1.43 on the PACES, and participants in the control group scored an average of 4.90 ± 1.44 . At T2, participants in the intervention groups scored an average of 5.05 ± 1.48 , whereas participants in the control group scored an average of 4.85 ± 1.21 . Comparisons between groups revealed that the steps group experienced the largest increase in enjoyment levels from T1 to T2 ($d = 0.47$), followed by the minutes group ($d = 0.14$). The combination group and control group both experienced no change in enjoyment level from T1 to T2 ($d = 0.07, d = -0.04$), respectively. **Table 6** displays average enjoyment scores across time for each group.

Table 6. Average enjoyment scores by group at T1, Week 1, and T2.

	T1 (M ± SD)	W1 (M ± SD)	T2 (M ± SD)	Effect Size (d) for T1 and T2
Steps group	4.51 ± 1.25	5.18 ± 0.91	5.15 ± 1.45	0.47
Minutes group	4.90 ± 1.55	5.51 ± 1.43	5.14 ± 1.77	0.14
Combination group	4.75 ± 1.49	4.94 ± 1.47	4.85 ± 1.21	0.07
Control group	4.90 ± 1.44	4.58 ± 1.42	4.84 ± 1.55	-0.04

Correlations were conducted to examine the relationships among step-count, minutes of MVPA, self-efficacy, and enjoyment from T1 to T2. Correlations revealed a non-statistically significant weak positive correlation between steps and self-efficacy ($r = .116, p = .482$), steps and enjoyment ($r = .136, p = .403$), minutes and self-efficacy ($r = .014, p = .930$), and minutes and enjoyment ($r = .079, p = .630$). Correlations between self-efficacy and enjoyment, and between steps and minutes both revealed statistically significant weak positive correlations ($r = .350, p = .031$) and ($r = .820, p = .000$), respectively. **Table 7** displays change score correlations among steps, change in minutes, change in self-efficacy, and change in enjoyment from T1 to T2. **Table 8** displays correlations among steps, minutes, self-efficacy, and enjoyment at T1 and T2.

Table 7. Correlations among changes in steps, minutes, self-efficacy, and enjoyment from T1 to T2.

	Steps	Minutes	Self-efficacy	Enjoyment
Steps	1	.820**	.116	.136
Minutes	.820**	1	.014	.079
Self-efficacy	.116	.014	1	.350*
Enjoyment	.136	.079	.350*	1

* $p < .05$

** $p < .01$

Table 8. Correlations among steps, minutes, self-efficacy, and enjoyment at T1 and T2.

	Steps (T1)	Minutes (T1)	Self-efficacy (T1)	Enjoyment (T1)	Steps (T2)	Minutes (T2)	Self-efficacy (T2)	Enjoyment (T2)
Steps (T1)	1	.784**	-.092	.343*	.402**	.467**	-.099	.394*
Minutes (T1)	.784**	1	-.005	.350*	.399**	.599**	-.020	.305
Self-efficacy (T1)	-.092	-.005	1	.185	-.136	-.109	.349*	.015
Enjoyment (T1)	.343*	.350*	.185	1	.203	.267	-.112	.609**
Steps (T2)	.402**	.399**	-.136	.203	1	.859**	-.012	.339*
Minutes (T2)	.467**	.599**	-.109	.267	.859**	1	-.075	.286
Self-efficacy (T2)	-.099	-.020	.349*	-.112	-.012	-.075	1	.090
Enjoyment (T2)	.394*	.305	.015	.609**	.339*	.286	.090	1

* $p < .05$

** $p < .01$

Debriefing

Frequencies and case summaries were used to analyze data from the debriefing questionnaire. Most of the participants in the steps group [$n = 6$ (66.7%)] reported focusing on meeting step-count goals ‘often’ or ‘always’ throughout the study. Some participants in the steps group [$n = 4$ (44.4%)] reported sometimes focusing on meeting a minutes-based goal in addition to their step-count goal. Over half of the participants in the steps group [$n = 5$ (55.6%)] reported checking their pedometer for number of activity minutes ‘less than one time daily’ or ‘never’, and most [$n = 7$ (77.8%)] reported checking their pedometer for their step-count ‘more than one time daily’.

When asked if they focused on a steps-based goal, minutes-based goal, both, or neither, only some of the participants in the minutes group [$n = 2$ (18.2%)] indicated that they focused on meeting minutes-based goals alone. The majority of the participants in the minutes group [$n = 6$ (54.5%)] reported focusing on both minutes-based and step-count goals at least some of the time. Most of the participants in the minutes group [$n = 8$ (72.7%)] reported checking their pedometer for number of activity minutes at least one time daily, whereas some [$n = 4$ (36.4%)] reported checking their pedometer for step-count in addition to activity minutes at least one time daily.

Most of the participants in the combination group [$n = 8$ (72.7%)] reported focusing on meeting a combination of step-count and minutes-based goals either ‘sometimes’ or ‘often,’ whereas only some of the participants [$n = 2$ (18.2%)] in the combination group reported meeting these goals ‘always.’ The majority of the participants in the combination group [$n = 7$ (63.6%)] reported checking their pedometer for both step-count and activity minutes at least once daily, and one [$n = 1$ (9.1%)] participant reported checking their pedometer only for step-count.

Most of the participants in the control group [$n = 6$ (60%)] reported focusing on meeting activity goals ‘rarely’ or ‘sometimes,’ whereas others in the control group reported focusing on goals ‘often’ [$n = 1$ (10%)] or ‘never’ [$n = 2$ (20%)]. Most of the participants in the control group [$n = 6$ (60%)] reported checking their pedometer ‘less than one time daily’ or ‘never’ for either step-count or activity minutes.

CHAPTER 5: DISCUSSION

Although the importance of meeting physical activity guidelines is well established, over half (52.5%) of the population fails to meet aerobic physical activity recommendations (Schoenborn & Stommel, 2011). To meet physical activity guidelines, several studies have provided recommendations for daily physical activity that include either step-count or minutes-based goals. Recommendations emphasizing step count have been shown to produce greater increases in physical activity than minute-based recommendations (Baker et al., 2011; Hultquist et al., 2005; Marshall et al., 2009; Pal et al., 2011; Tudor-Locke et al., 2011). However, a combination of these recommendations has yet to be examined. This study examined the impact of a step-count goal, a minutes-based goal, and a combination goal (steps and minutes) on physical activity, self-efficacy, and enjoyment. The relationship between change in self-efficacy and enjoyment and post-intervention physical activity was also examined.

Findings from previous studies suggest that a physical activity goal focused on step-count is more effective than a minute-based goal for increasing physical activity (Baker et al., 2011; Hultquist et al., 2005; Marshall et al., 2009; Pal et al., 2011; Tudor-Locke et al., 2011). The overall findings in this study were not consistent with previous literature. All three intervention groups had similar increases in step counts and differences in step-count from T1 to T2 were not significant within groups. On days in which goals were met, the combination group averaged 12,828 steps/day whereas the steps group averaged 10,765 steps/day. On days in which goals were unmet, the combination group averaged 7,715 steps/day whereas the steps group averaged 5,858 steps/day. The minutes group showed the largest increase in daily minutes of MVPA from T1 to T2, and the control group decreased in minutes and step counts from T1 to T2. On days in which goals were met, the combination group reached a higher number of minutes of MVPA

than the minutes group. On days in which goals were unmet, the combination group reached a higher number of steps than the steps group and a higher number of minutes of MVPA than the minutes group.

One explanation for why the current study's overall findings are not consistent with previous literature is because this study provided a pedometer that allowed objective monitoring of minute-based goals whereas other studies did not provide this type of monitoring device. Findings from the debriefing questionnaire showed that participants in the steps group checked their pedometer often for activity minutes, and participants in the minutes group checked their pedometer often for step-count. The lack of statistically significant differences between groups may be due to participants checking their pedometers often for something other than what corresponded to their given activity recommendation.

Although the number of daily steps increased similarly for all intervention groups across the study, none of the groups reported an increase in self-efficacy. These findings are similar to Samuels et al.'s findings (2011) in which participants in all conditions showed decreased self-efficacy across the intervention. It is known that self-efficacy is a strong predictor of the adoption and maintenance of physical activity behavior (Williams & French, 2011). Baker et al. (2008) found success in using a graduated walking program to increase walking. However, self-efficacy was not measured in their study. In the current study, the purpose of the graduated walking program was to increase self-efficacy through mastery experiences. Mastery experiences are one known way to raise self-efficacy (Bandura, 2004; Williams & French, 2011). Findings from Jones et al.'s study (2005) suggest high outcome expectations may lead to lowered self-efficacy whereas realistic outcome expectations may increase success and raise self-efficacy. Therefore, future studies may be more successful at increasing self-efficacy if the participants'

walking recommendations are increased only if they met their previous walking goal. These data might also suggest that interventions aimed at increasing physical activity need to provide participants with other strategies for increasing self-efficacy such as providing feedback from a member of the research team, vicarious experiences, or help with overcoming barriers to physical activity.

It is known that enjoyment and self-efficacy both influence physical activity behavior and that participants with high self-efficacy also report greater enjoyment in physical activity (Hu et al., 2007). In the current study, however, self-efficacy decreased over time whereas enjoyment and activity level increased over time. These findings are similar to Lewis et al.'s findings (2016) which suggest that enjoyment is a greater influence on physical activity behavior than is self-efficacy. Therefore, it is important to increase physical activity enjoyment in activity promotion efforts.

Although weak and not statistically significant, increases in enjoyment were correlated with increases in step-count in the current study. These results are in line with previous research indicating that increased levels of enjoyment result in increased physical activity (Dishman et al., 2005). The current study only measured enjoyment over time, but did not aim to increase enjoyment levels. Future studies should incorporate ways to raise levels of enjoyment throughout the intervention because enjoyment is an important component of physical activity adherence and increasing exercise enjoyment may contribute to long-term adherence to physical activity (Hagberg et al., 2009).

This intervention was relatively minimal in that participants were only asked to meet small activity recommendations related to step-count or minutes of MVPA over a short time. Although minimal, this intervention still showed small increases in physical activity. These

results provide important implications for public health efforts in activity promotion. For public health approaches, these small changes in physical activity can have a large impact on a community when implemented on a large scale or community level.

There are a few limitations to this study. First, the sample size was relatively small. To achieve a statistical power of 0.80, we needed a minimum of 40 participants to detect moderate differences between groups. Although we were able to analyze 41 participants, a larger sample size would have increased the chances of finding any smaller differences that may have existed between groups. During the recruitment of participants for this study, a hurricane affected the area with major flooding. This had an impact on the number of people who followed through with enrollment and participation in the study. Second, accelerometers are limited as physical activity measurement devices because they might not capture all activities such as swimming, weightlifting, or bike-riding. Future studies may benefit by including activity journals in which participants can write down such activities that may not be recorded by a pedometer. Third, participants in all groups could see their step-count and their minutes of MVPA throughout the intervention, regardless of the physical activity goal they were asked to meet. This made it difficult to distinguish which activity goals were most effective since there were participants in all groups who looked at both step-count and minutes of MVPA throughout the study. Future studies should consider using activity monitors in which participants can only see activity related to their given goals. Fourth, this study did not attempt to raise exercise enjoyment throughout the study. Enjoyment is a key factor for adopting and maintaining physical activity behavior, so a focus on exercise enjoyment is important for future interventions. In addition to raising enjoyment, future research should consider raising self-efficacy, perhaps by increasing a participant's activity goal only if he or she met their previous goals. Future studies in this area

should also consider a longer-term intervention to examine the effects of these recommendations over the long term. Finally, the intervention ended the week prior to Thanksgiving. Having a physical activity intervention so close to a major holiday may have impacted the effectiveness of the physical activity recommendations that were given.

The results of this study suggest that physical activity recommendations set in steps, minutes, or a combination of steps and minutes are effective for increasing daily step-count over a short period. A physical activity goal set in steps does not appear to be effective for increasing minutes of MVPA unless combined with a minutes goal. Although the effect size was small, a combination approach appears to increase both step-count and minutes of MVPA. The combination approach of recommending both a steps-based and minutes-based activity goal should be further examined to determine its implications for increasing physical activity intensity as well as amount of physical activity accumulated throughout the day. Overall, these results suggest that simply recommending an activity goal is effective for creating small increases in daily step-counts, regardless of whether the goal is based on step-count, minutes of MVPA, or both.

When providing recommendations to increase physical activity in the general population, a minutes-based activity goal may be more effective for increasing both step-count and minutes of MVPA compared to a step-count goal or a combination goal. In the current study, the minutes goal was more effective for increasing both step-count and minutes of MVPA compared to the steps-based goal. A combination recommendation may be too overwhelming, especially for people who are not physically active at the time of the recommendation.

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APPENDIX A

INSTITUTIONAL REVIEW BOARD APPROVAL LETTER



EAST CAROLINA UNIVERSITY
University & Medical Center Institutional Review Board Office
4N-70 Brody Medical Sciences Building· Mail Stop 682
600 Moye Boulevard · Greenville, NC 27834
Office 252-744-2914 · Fax 252-744-2284 · www.ecu.edu/irb

Notification of Initial Approval: Expedited

From: Biomedical IRB

To: [Olivia Edwards](#)

CC:

[Deirdre Dlugonski](#)

Date: 9/20/2016

Re: [UMCIRB 16-001628](#)

Physical Activity Recommendations

I am pleased to inform you that your Expedited Application was approved. Approval of the study and any consent form(s) is for the period of 9/17/2016 to 9/16/2017. The research study is eligible for review under expedited category # 4,7. The Chairperson (or designee) deemed this study no more than minimal risk.

Changes to this approved research may not be initiated without UMCIRB review except when necessary to eliminate an apparent immediate hazard to the participant. All unanticipated problems involving risks to participants and others must be promptly reported to the UMCIRB. The investigator must submit a continuing review/closure application to the UMCIRB prior to the date of study expiration. The Investigator must adhere to all reporting requirements for this study.

Approved consent documents with the IRB approval date stamped on the document should be used to consent participants (consent documents with the IRB approval date stamp are found under the Documents tab in the study workspace).

The approval includes the following items:

Name	Description
Debriefing Questions.docx	Surveys and Questionnaires
Demographic & Health History.doc	Surveys and Questionnaires
EXERCISE BARRIERS SCALE_Pineda_edits.docx	Surveys and Questionnaires
Exercise Goal setting and planning scales.docx	Surveys and Questionnaires
exercise self_efficacy scale_combo.doc	Surveys and Questionnaires
exercise self_efficacy scale_control.doc.docx	Surveys and Questionnaires
exercise_self-efficacy_scale_minutes.docx	Surveys and Questionnaires
exercise_self-efficacy_scale_steps.docx	Surveys and Questionnaires
Informed Consent Document.doc	Consent Forms
MOEES.pdf	Surveys and Questionnaires
MOS Social Support.doc	Surveys and Questionnaires
PACES.docx	Surveys and Questionnaires
PAR-Q.pdf	Surveys and Questionnaires
Recruitment Flyer.doc	Recruitment Documents/Scripts
Thesis_Chapters123_OAE.docx	Study Protocol or Grant Application
Weekly email reminder templates for control group	Additional Items
Weekly email reminder templates for intervention groups	Additional Items

The Chairperson (or designee) does not have a potential for conflict of interest on this study.

APPENDIX B

INFORMED CONSENT DOCUMENT

East Carolina University



Informed Consent to Participate in Research

Information to consider before taking part in research that has no more than minimal risk.

Title of Research Study: Physical Activity Recommendations

Principal Investigator: Abby Edwards (Person in Charge of this Study)
Institution, Department or Division: East Carolina University, Department of Kinesiology
Address: Minges Coliseum, East Carolina University
Telephone #: 252-737-2266
Study Coordinator: Dr. Dee Dlugonski
Telephone #: 252-328-5266

Researchers at East Carolina University (ECU) study issues related to society, health problems, environmental problems, behavior problems and the human condition. To do this, we need the help of volunteers who are willing to take part in research.

Why am I being invited to take part in this research?

The purpose of this research is to learn ways in which we can increase physical activity levels in the general population. You are being invited to take part in this research because you are a healthy volunteer. The decision to take part in this research is yours to make. By doing this research, we hope to learn how to increase physical activity levels in the general population.

If you volunteer to take part in this research, you will be one of about 60-72 people to do so.

Are there reasons I should not take part in this research?

You should not volunteer for this study if you are under 18 years of age or over 64 years of age. You should not volunteer for this study if you are not healthy enough for physical activity. You should not volunteer for this study if you are pregnant or if you have had a baby within the past 6 weeks.

What other choices do I have if I do not take part in this research?

You can choose not to participate.

Where is the research going to take place and how long will it last?

The research will be conducted at Minges Coliseum at East Carolina University. You will need to come to the research lab in room 176 Minges Coliseum 4 times during the study. The total amount of time you will be asked to volunteer for this study is approximately 4 hours over the next 6 weeks. Additionally, you will be asked to wear a pedometer daily and log information about wearing the pedometer.

What will I be asked to do?

You will be asked to do the following:

- Baseline testing (1 week)
 - Complete a demographic questionnaire
 - Have your height and weight measured

- Wear an accelerometer daily for 1 week (The accelerometer will be provided to you by research staff. You will return the accelerometer at the end of week 1.)
- Wear a pedometer daily for 1 week (The pedometer will be provided to you by research staff. You will wear the pedometer throughout the study and return it at the end of the study.)
- You may be asked to complete an exercise self-efficacy questionnaire. This questionnaire will assess your beliefs in your ability to be physically active.
- You may be asked to complete questionnaires to measure exercise enjoyment, exercise barriers, outcome expectations, social support, and goal setting.
- Weeks 1-4 (after baseline testing; 4 weeks)
 - Wear a pedometer daily for 4 weeks.
 - Increase your daily physical activity following specific guidelines
 - You may be asked to complete an activity log every day for 4 weeks. The activity log will be in paper format and will be fill-in the blank. You will enter the information from your activity log into an online survey at the end of each week for 4 weeks.
 - You may be asked to complete a questionnaire assessing exercise self-efficacy after week 1
- Post-test (after weeks 1-4; 1 week)
 - Wear an accelerometer daily for 1 week (The accelerometer will be provided to you by research staff. You will return the accelerometer at the end of the study.)
 - You may be asked to complete a questionnaire assessing exercise self-efficacy after week 4
 - You may be asked to complete questionnaires to measure exercise enjoyment, exercise barriers, outcome expectations, social support, and goal setting after week 4
 - You may be asked to complete a questionnaire about the study after week 4
- If you are asked to complete an activity log, you will be sent weekly email reminders (once per week for four weeks (Weeks 1-4) throughout the study) to enter your activity log data into an online survey.
- Come to the research lab in room 176 Minges Coliseum 4 times over the course of the study to participate in testing before and after the research study.

What might I experience if I take part in the research?

Other people who have taken part in this type of research have experienced increased levels of physical activity. You may experience minor muscle soreness from increasing your physical activity.

Will I be paid for taking part in this research?

We will not be able to pay you for the time you volunteer while being in this study. However, for each stage of the study you complete, you will be entered into a raffle to win one of four \$50 gift cards. There are 6 possible stages for this study that include completion of: baseline testing, 4 weekly physical activity logs on Qualtrics, and post-intervention testing. Drawings will take place at the end of the study.

Will it cost me to take part in this research?

It will not cost you any money to be part of the research.

Who will know that I took part in this research and learn personal information about me?

ECU and the people and organizations listed below may know that you took part in this research and may see information about you that is normally kept private. With your permission, these people may use your private information to do this research:

- Any agency of the federal, state, or local government that regulates human research. This includes the Department of Health and Human Services (DHHS), the North Carolina Department of Health, and the Office for Human Research Protections.
- The University & Medical Center Institutional Review Board (UMCIRB) and its staff have responsibility for overseeing your welfare during this research and may need to see research records that identify you.

- People designated by East Carolina University;
- If you are a patient at ECU or Vidant, a copy of the first page of this form will be placed in your medical records.

How will you keep the information you collect about me secure? How long will you keep it?

Records will be stored in a locked filing cabinet within a locked room in Minges Coliseum and will only be accessible by key by a select number of users. Records will be stored for 7 years.

What if I decide I don't want to continue in this research?

You can stop at any time after it has already started. There will be no consequences if you stop and you will not be criticized. You will not lose any benefits that you normally receive.

Who should I contact if I have questions?

The people conducting this study will be able to answer any questions concerning this research, now or in the future. You may contact the Principal Investigator, Abby Edwards, at 252-737-2266 or the faculty supervisor, Dr. Dee Dlugonski, at 252-328-5266 Monday through Friday between the hours of 9am and 5pm.

If you have questions about your rights as someone taking part in research, you may call the Office of Research Integrity & Compliance (ORIC) at phone number 252-744-2914 (days, 8:00 am-5:00 pm). If you would like to report a complaint or concern about this research study, you may call the Director of the ORIC, at 252-744-1971

I have decided I want to take part in this research. What should I do now?

The person obtaining informed consent will ask you to read the following and if you agree, you should sign this form:

- I have read (or had read to me) all of the above information.
- I have had an opportunity to ask questions about things in this research I did not understand and have received satisfactory answers.
- I know that I can stop taking part in this study at any time.
- By signing this informed consent form, I am not giving up any of my rights.
- I have been given a copy of this consent document, and it is mine to keep.

Participant's Name (PRINT)

Signature

Date

Person Obtaining Informed Consent: I have conducted the initial informed consent process. I have orally reviewed the contents of the consent document with the person who has signed above, and answered all of the person's questions about the research.

Person Obtaining Consent (PRINT)

Signature

Date

APPENDIX C
RECRUITMENT FLYER



Volunteers Needed for Research Study

Description of Study:

We are examining the impact of different physical activity recommendations. The study will last a total of 6 weeks. We will ask you to wear a pedometer for 5 weeks and record your daily physical activity.

To participate:

- You must be between the ages of 18 and 64,
- Must be healthy enough to participate in physical activity, and
- Want to become more active.

Compensation:

Participants will have the opportunity for multiple entries into a raffle to win one of four \$50 gift cards.

To learn more, contact the principal investigator of the study, Abby Edwards:

252.737.2266

edwardsol10@students.ecu.edu.

This research is conducted under the direction of Dr. Deirdre Dlugonski, Kinesiology Department, and has been reviewed and approved by the University & Medical Center Institutional Review Board.

APPENDIX D
QUESTIONNAIRES

- 1. Demographic and Health History**
- 2. Physical Activity Enjoyment Scale (PACES)**
- 3. Exercise Self Efficacy Scale for control group**
- 4. Exercise Self Efficacy Scale for steps group**
- 5. Exercise Self Efficacy Scale for minutes group**
- 6. Exercise Self Efficacy Scale for combination group**
- 7. Debriefing Questions**

Demographic & Health Information

I would like to ask you about your family background – age, education, the work you do, your marital status, and family health status.

1. What is your age? _____ years
2. What is your sex? (check one)
☐ 1. Female
☐ 2. Male
3. What is your race/ethnicity? (check one)
☐ 1. African American ☐ 3. Hispanic ☐ 5. Native American
☐ 2. Non-Hispanic white ☐ 4. Asian ☐ 6. Other
4. Which best reflects your highest level of education? (check one)
☐ 1. Did not complete high school
☐ 2. Graduated from high school or earned GED
☐ 3. Attended college or vocational school
☐ 4. Earned a college degree (Bachelor's)
☐ 5. Earned a graduate degree (Masters, Doctoral, Professional)
☐ 7. Don't know/refused
5. Do you work for a living?
☐ 1. No (go to question 8)
☐ 2. Yes
☐ 7. Don't know/ Refused
6. Which best describes the hours you work?
☐ 1. Part time
☐ 2. Full time
☐ 7. Don't know/ Refused
7. What type of work do you do?

12. Which best describes your marital status? (check one)
- ☐ 1. Married
 - ☐ 2. Living as married
 - ☐ 3. Widowed
 - ☐ 4. Divorced
 - ☐ 5. Never married/single
 - ☐ 6. Separated
 - ☐ 7. Don't know/refused
13. Do you have children?
- ☐ 1. No (go to question 15)
 - ☐ 2. Yes
 - ☐ 7. Don't know/refused
14. Please list the age and sex of each child you have:
- _____
15. Which best describes the place you live? (check one)
- ☐ 1. Large city [>100,000 people; like Raleigh, NC]
 - ☐ 2. Medium city [30,000-100,000 people; like Goldsboro or Greenville, NC]
 - ☐ 3. Rural city [<30,000 people; like Havelock or New Bern, NC]
 - ☐ 4. Small city [<1,000 people; like Black Creek or Bath, NC]
 - ☐ 5. In the country, no city
 - ☐ 7. Don't know/refused
16. Which best describes your household income in the past year? (check one)
- ☐ 1. < \$15,999
 - ☐ 2. \$16,000 to \$24,999
 - ☐ 3. \$25,000 to \$34,999
 - ☐ 4. \$35,000 to \$49,999
 - ☐ 5. \$50,000 to \$74,999
 - ☐ 6. \$75,000 and greater
 - ☐ 7. Don't know/refused
17. During the past month, did you participate in any physical activities or exercises such as running, calisthenics, golf, gardening, or walking for exercise?
- ☐ 1. No
 - ☐ 2. Yes
 - ☐ 7. Don't know/ Refused

18. Do you currently smoke cigarettes?

- ☐ 1. No
☐ 2. Yes
☐ 7. Don't know/ Refused

Has a health care provider ever told anyone in your family (e.g., you, your spouse, your parents) that they have any of the following conditions?

	No (1)	Yes (2)	Don't know/refused (7)	Relation to you (mother, father, etc.)
17. Diabetes (high sugar)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
18. High blood pressure	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
19. High cholesterol	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
20. Heart disease	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
21. Stroke	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
22. Cancer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
23. Arthritis or joint pain	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
24. Overweight	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>
25. Breathing problems	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="text"/>

26. Would you say that in general your health is

- ☐ 1. Excellent
☐ 2. Very good
☐ 3. Good
☐ 4. Fair
☐ 5. Poor
☐ 7. Don't know/refused

27. Compared to others is your health

- ☐ 1. Excellent
☐ 2. Very good
☐ 3. Good
☐ 4. Fair
☐ 5. Poor
☐ 7. Don't know/refused

28. Now, thinking about your physical health, which includes physical illness and injury, have there been any days in the past 30 days that your physical health was not good?

- ☐ 1. No (go to question 30)
☐ 2. Yes
☐ 7. Don't know/ Refused

29. How many days in the past month was your health not good?
_____ days
30. During the past 30 days, were there any days that poor physical health kept you from doing your usual activities?
____ 1. No (go to question 32)
____ 2. Yes
____ 7. Don't know/ Refused
31. How many days in the past month were you unable to do your usual activities?
_____ days
32. Compared with others, how do you rate your level of physical strength?
____ 1. Much more than others
____ 2. More than others
____ 3. About as much as others
____ 4. Less than others
____ 5. Much less than others
____ 7. Don't know/refused
33. Compared with others, how do you rate your level of physical activity?
____ 1. Much more than others
____ 2. More than others
____ 3. About as much as others
____ 4. Less than others
____ 5. Much less than others
____ 7. Don't know/refused

Physical Activity Enjoyment Scale (PACES)

For the next 8 items, please select the number between each pair of statements that BEST describes how you feel about the physical activity you have been doing in the past month.

	1	2	3	4	5	6	7	
I enjoyed it	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	I hated it
I felt bored	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	I felt interested
I disliked it	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	I liked it
I found it pleasurable	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	I found it unpleasurable
It was no fun at all	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	It was a lot of fun
It was very pleasant	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	It was very unpleasant
I felt as though I would rather be doing something else	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	I felt as though there was nothing else I would rather be doing
I was very absorbed in the activity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	I was not at all absorbed in the activity

Exercise Self Efficacy Scale for control group

Exercise Self-Efficacy Scale

The items listed below are designed to assess your beliefs in your ability to accumulate 150 minutes of moderate-to-vigorous intensity aerobic activity, such as brisk walking, each week in the upcoming weeks. Moderate activities are similar to a brisk walk and vigorous activities are similar to what it feels like to run. For this activity, please only consider physical activities that occur for 10 minutes at a time. Using the scales listed below please indicate how confident you are that you will be able to be physically active in the future.

For example, if you have complete confidence that you could accumulate 150 minutes of moderate-to-vigorous intensity aerobic activity, such as brisk walking in the next week, you would **circle 100%**. However, if you had no confidence at all that you could participate in physical activity for the next week without quitting, you would **circle 0%**.

Please remember to answer honestly and accurately. There are no right or wrong answers.

	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	
	NOT AT ALL CONFIDENT				MODERATELY CONFIDENT				HIGHLY CONFIDENT			
1. I am able to participate in physical activity most days of the week at moderate intensity to accumulate <u>150 minutes of physical activity per week</u> without quitting for the <u>NEXT WEEK</u> .	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	
2. I am able to participate in physical activity most days of the week at moderate intensity to accumulate <u>150 minutes of physical activity per week</u> without quitting for the <u>NEXT TWO WEEKS</u> .	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	
3. I am able to participate in physical activity most days of the week at moderate intensity to accumulate <u>150 minutes of physical activity per week</u> without quitting for the <u>NEXT THREE WEEKS</u> .	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	
4. I am able to participate in physical activity most days of the week at moderate intensity to accumulate <u>150 minutes of physical activity per week</u> without quitting for the <u>NEXT FOUR WEEKS</u> .	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	
5. I am able to participate in physical activity most days of the week at moderate intensity to accumulate <u>150 minutes of physical activity per week</u> without quitting for the <u>NEXT FIVE WEEKS</u> .	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	
6. I am able to participate in physical activity most days of the week at moderate intensity to accumulate <u>150 minutes of physical activity per week</u> without quitting for the <u>NEXT SIX WEEKS</u> .	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	

7. I am able to participate in physical activity most days of the week at moderate intensity to accumulate 150 minutes of physical activity per week without quitting for the NEXT SEVEN WEEKS.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

8. I am able to participate in physical activity most days of the week at moderate intensity to accumulate 150 minutes of physical activity per week without quitting for the NEXT EIGHT WEEKS.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Exercise Self Efficacy Scale for steps group

Exercise Self-Efficacy Scale

The items listed below are designed to assess your beliefs in your ability to accumulate 10,000 steps or more on most days of the week in the upcoming weeks. Using the scales listed below please indicate how confident you are that you will be able to be physically active in the future.

For example, if you have complete confidence that you could accumulate 10,000 steps or more on most days of the week in the next week, you would **circle 100%**. However, if you had no confidence at all that you could accumulate 10,000 steps for the next week without quitting, you would **circle 0%**.

Please remember to answer honestly and accurately. There are no right or wrong answers.

	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	
	NOT AT ALL CONFIDENT				MODERATELY CONFIDENT				HIGHLY CONFIDENT			
1. I am able to accumulate <u>10,000 steps or more</u> for 5 days per week without quitting for the <u>NEXT WEEK</u> .	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	
2. I am able to accumulate <u>10,000 steps or more</u> for 5 days per week without quitting for the <u>NEXT TWO WEEKS</u> .	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	
3. I am able to accumulate <u>10,000 steps or more</u> for 5 days per week without quitting for the <u>NEXT THREE WEEKS</u> .	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	
4. I am able to accumulate <u>10,000 steps or more</u> for 5 days per week without quitting for the <u>NEXT FOUR WEEKS</u> .	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	
5. I am able to accumulate <u>10,000 steps or more</u> for 5 days per week without quitting for the <u>NEXT FIVE WEEKS</u> .	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	
6. I am able to accumulate <u>10,000 steps or more</u> for 5 days per week without quitting for the <u>NEXT SIX WEEKS</u> .	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	
7. I am able to accumulate <u>10,000 steps or more</u> for 5 days per week without quitting for the <u>NEXT SEVEN WEEKS</u> .	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	
8. I am able to accumulate <u>10,000 steps or more</u> for 5 days per week without quitting for the <u>NEXT EIGHT WEEKS</u> .	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	

Exercise Self Efficacy Scale for minutes group

Exercise Self-Efficacy Scale

The items listed below are designed to assess your beliefs in your ability to accumulate 30 or more minutes of moderate to vigorous physical activity on most days of the week in the upcoming weeks. Moderate activities are similar to a brisk walk and vigorous activities are similar to what it feels like to run. For this activity, please only consider physical activities that occur for 10 minutes at a time. Using the scales listed below please indicate how confident you are that you will be able to be physically active in the future.

For example, if you have complete confidence that you could accumulate 30 or more minutes of moderate to vigorous physical activity on most days of the week in the next week, you would **circle 100%**. However, if you had no confidence at all that you could participate in physical activity for the next week without quitting, you would **circle 0%**.

Please remember to answer honestly and accurately. There are no right or wrong answers.

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
NOT AT ALL CONFIDENT					MODERATELY CONFIDENT					HIGHLY CONFIDENT

1. I am able to participate in physical activity for **5 days** per week at moderate intensity, for 30 minutes or more without quitting for the NEXT WEEK.

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
----	-----	-----	-----	-----	-----	-----	-----	-----	-----	------

2. I am able to participate in physical activity for **5 days** per week at moderate intensity, for 30 minutes or more without quitting for the NEXT TWO WEEKS.

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
----	-----	-----	-----	-----	-----	-----	-----	-----	-----	------

3. I am able to participate in physical activity for **5 days** per week at moderate intensity, for 30 minutes or more without quitting for the NEXT THREE WEEKS.

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
----	-----	-----	-----	-----	-----	-----	-----	-----	-----	------

4. I am able to participate in physical activity for **5 days** per week at moderate intensity, for 30 minutes or more without quitting for the NEXT FOUR WEEKS.

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
----	-----	-----	-----	-----	-----	-----	-----	-----	-----	------

5. I am able to participate in physical activity for **5 days** per week at moderate intensity, for 30 minutes or more without quitting for the NEXT FIVE WEEKS.

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
----	-----	-----	-----	-----	-----	-----	-----	-----	-----	------

6. I am able to participate in physical activity for **5 days** per week at moderate intensity, for 30 minutes or more without quitting for the NEXT SIX WEEKS.

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
----	-----	-----	-----	-----	-----	-----	-----	-----	-----	------

7. I am able to participate in physical activity for **5 days** per week at moderate intensity, for 30 minutes or more without quitting for the NEXT SEVEN WEEKS.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

8. I am able to participate in physical activity for **5 days** per week at moderate intensity, for 30 minutes or more without quitting for the NEXT EIGHT WEEKS.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Exercise Self Efficacy Scale for combination group

Exercise Self-Efficacy Scale

The items listed below are designed to assess your beliefs in your ability to accumulate 30 or more minutes of moderate to vigorous physical activity and 10,000 steps or more on most days of the week in the upcoming weeks. Moderate activities are similar to a brisk walk and vigorous activities are similar to what it feels like to run. For this activity, please only consider physical activities that occur for 10 minutes at a time. Using the scales listed below please indicate how confident you are that you will be able to be physically active in the future.

For example, if you have complete confidence that you could accumulate 30 or more minutes of moderate to vigorous physical activity and 10,000 steps or more on most days of the week in the next week, you would **circle 100%**. However, if you had no confidence at all that you could participate in physical activity for the next week without quitting, you would **circle 0%**.

Please remember to answer honestly and accurately. There are no right or wrong answers.

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
NOT AT ALL CONFIDENT					MODERATELY CONFIDENT					HIGHLY CONFIDENT

1. I am able to participate in physical activity for **5 days** per week at moderate intensity, for 30+ minutes and accumulate 10,000 steps without quitting for the NEXT WEEK.

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
----	-----	-----	-----	-----	-----	-----	-----	-----	-----	------

2. I am able to participate in physical activity for **5 days** per week at moderate intensity, for 30+ minutes and accumulate 10,000 steps without quitting for the NEXT TWO WEEKS.

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
----	-----	-----	-----	-----	-----	-----	-----	-----	-----	------

3. I am able to participate in physical activity for **5 days** per week at moderate intensity, for 30+ minutes and accumulate 10,000 steps without quitting for the NEXT THREE WEEKS.

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
----	-----	-----	-----	-----	-----	-----	-----	-----	-----	------

4. I am able to participate in physical activity for **5 days** per week at moderate intensity, for 30+ minutes and accumulate 10,000 steps without quitting for the NEXT FOUR WEEKS.

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
----	-----	-----	-----	-----	-----	-----	-----	-----	-----	------

5. I am able to participate in physical activity for **5 days** per week at moderate intensity, for 30+ minutes and accumulate 10,000 steps without quitting for the NEXT FIVE WEEKS.

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
----	-----	-----	-----	-----	-----	-----	-----	-----	-----	------

6. I am able to participate in physical activity for **5 days** per week at moderate intensity, for 30+ minutes and accumulate 10,000 steps without quitting for the NEXT SIX WEEKS.

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
----	-----	-----	-----	-----	-----	-----	-----	-----	-----	------

7. I am able to participate in physical activity for **5 days** per week at moderate intensity, for 30+ minutes and accumulate 10,000 steps without quitting for the NEXT SEVEN WEEKS.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

8. I am able to participate in physical activity for **5 days** per week at moderate intensity, for 30+ minutes and accumulate 10,000 steps without quitting for the NEXT EIGHT WEEKS.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Debriefing Questions

1. To what extent did you focus on meeting a step-count goal during this study? (check one)
☐ Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always

2. To what extent did you focus on meeting a minutes-based goal during this study? (check one)
☐ Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always

3. To what extent did you focus on meeting both a step-count and a minutes-based goal during this study? (check one)
☐ Never ☐ Rarely ☐ Sometimes ☐ Often ☐ Always

4. Did you check your pedometer for activity minutes, step counts, or both? (check one)
☐ Activity minutes
☐ Steps taken
☐ Both

5. How often did you check your pedometer for activity minutes? (check one)
☐ More than 1 time daily
☐ 1 time daily
☐ Less than 1 time daily
☐ Never

6. How often did you check your pedometer for number of steps? (check one)

- ☐ More than 1 time daily
- ☐ 1 time daily
- ☐ Less than 1 time daily
- ☐ Never

7. Did you know any other participants in this study? **Y/N**

7a. If yes, were you aware of their physical activity goal(s)? **Y/N**

7b. If yes, what was/were their goal(s)? (check one)

- ☐ Accumulate a specific number of steps each week
- ☐ Accumulate a specific number of minutes of physical activity each week
- ☐ Both of the above
- ☐ Don't know/not sure

8. Please use the space below for any additional comments you wish to share with the study staff.

APPENDIX E

ACTIVITY LOGS

- 1. Accelerometer Log**
- 2. Physical Activity Log for steps group**
- 3. Physical Activity Log for minutes group**
- 4. Physical Activity Log for combination group**

Accelerometer Log

ID _____
Accelerometer # _____

Physical Activity Study, East Carolina University
Phone: _____ Email: _____

Accelerometer Log

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8
Date								
Time of day you put on the unit								
Time of day you took off the unit								
Any times you did not wear the unit?								

In the space provided below, please provide comments about problems that occurred while you were wearing the accelerometer.

Physical Activity Log for steps group

PHYSICAL ACTIVITY LOG

INSTRUCTIONS:

Please complete the tables below daily. 'Start Time' indicates the time at which you started wearing the pedometer that day. 'End Time' indicates the time at which you removed the pedometer for that day. If the pedometer is removed and then replaced at any time during the day (i.e., during a shower), please indicate the amount of time it was not worn and the reason why in the 'Additional Comments' column. An example is given below.

This log is for your records. At the end of each week, enter your information from the tables below into the survey on Qualtrics. A reminder to enter your information into Qualtrics will be sent via email each week.

EXAMPLE – WEEK 1				
Date	Start Time	End Time	# of Steps Taken	Additional Comments
Monday, 10/24	6:30 AM	11:00 PM	4,385	Removed for 23 minutes (shower); Removed for 47 minutes (swimming)

WEEK 1				
Date	Start Time	End Time	# of Steps Taken	Additional Comments
Tuesday, 10/25				
Wednesday, 10/26				
Thursday, 10/27				
Friday, 10/28				
Saturday, 10/29				
Sunday, 10/30				
Monday, 10/31				

WEEK 2				
Date	Start Time	End Time	# of Steps Taken	Additional Comments
Tuesday, 11/1				
Wednesday, 11/2				
Thursday, 11/3				
Friday, 11/4				
Saturday, 11/5				
Sunday, 11/6				
Monday, 11/7				

WEEK 3				
Date	Start Time	End Time	# of Steps Taken	Additional Comments
Tuesday, 11/8				
Wednesday, 11/9				
Thursday, 11/10				
Friday, 11/11				
Saturday, 11/12				
Sunday, 11/13				
Monday, 11/14				

WEEK 4				
Date	Start Time	End Time	# of Steps Taken	Additional Comments
Tuesday, 11/15				
Wednesday, 11/16				
Thursday, 11/17				
Friday, 11/18				
Saturday, 11/19				
Sunday, 11/20				
Monday, 11/21				

Physical Activity Log for minutes group

PHYSICAL ACTIVITY LOG

INSTRUCTIONS:

Please complete the tables below daily. 'Start Time' indicates the time at which you started wearing the pedometer that day. 'End Time' indicates the time at which you removed the pedometer for that day. If the pedometer is removed and then replaced at any time during the day (i.e., during a shower), please indicate the amount of time it was not worn and the reason why in the 'Additional Comments' column. An example is given below.

This log is for your records. At the end of each week, enter your information from the tables below into the survey on Qualtrics. A reminder to enter your information into Qualtrics will be sent via email each week.

EXAMPLE – WEEK 1				
Date	Start Time	End Time	Activity Minutes	Additional Comments
Monday, 10/24	6:30 AM	11:00 PM	31	Removed for 23 minutes (shower); Removed for 47 minutes (swimming)

WEEK 1				
Date	Start Time	End Time	Activity Minutes	Additional Comments
Tuesday, 10/25				
Wednesday, 10/26				
Thursday, 10/27				
Friday, 10/28				
Saturday, 10/29				
Sunday, 10/30				
Monday, 10/31				

WEEK 2				
Date	Start Time	End Time	Activity Minutes	Additional Comments
Tuesday, 11/1				
Wednesday, 11/2				
Thursday, 11/3				
Friday, 11/4				
Saturday, 11/5				
Sunday, 11/6				
Monday, 11/7				

WEEK 3				
Date	Start Time	End Time	Activity Minutes	Additional Comments
Tuesday, 11/8				
Wednesday, 11/9				
Thursday, 11/10				
Friday, 11/11				
Saturday, 11/12				
Sunday, 11/13				
Monday, 11/14				

WEEK 4				
Date	Start Time	End Time	Activity Minutes	Additional Comments
Tuesday, 11/15				
Wednesday, 11/16				
Thursday, 11/17				
Friday, 11/18				
Saturday, 11/19				
Sunday, 11/20				
Monday, 11/21				

Physical Activity Log for combination group

PHYSICAL ACTIVITY LOG

INSTRUCTIONS:

Please complete the tables below daily. 'Start Time' indicates the time at which you started wearing the pedometer that day. 'End Time' indicates the time at which you removed the pedometer for that day. If the pedometer is removed and then replaced at any time during the day (i.e., during a shower), please indicate the amount of time it was not worn and the reason why in the 'Additional Comments' column. An example is given below.

This log is for your records. At the end of each week, enter your information from the tables below into the survey on Qualtrics. A reminder to enter your information into Qualtrics will be sent via email each week.

EXAMPLE – WEEK 1					
Date	Start Time	End Time	# of Steps Taken	Activity Minutes	Additional Comments
Monday, 10/24	6:30 AM	11:00 PM	4,385	31	Removed for 23 minutes (shower); Removed for 47 minutes (swimming)

WEEK 1					
Date	Start Time	End Time	# of Steps Taken	Activity Minutes	Additional Comments
Tuesday, 10/25					
Wednesday, 10/26					
Thursday, 10/27					
Friday, 10/28					
Saturday, 10/29					
Sunday, 10/30					
Monday, 10/31					

WEEK 2					
Date	Start Time	End Time	# of Steps Taken	Activity Minutes	Additional Comments
Tuesday, 11/1					
Wednesday, 11/2					
Thursday, 11/3					
Friday, 11/4					
Saturday, 11/5					
Sunday, 11/6					
Monday, 11/7					

WEEK 3					
Date	Start Time	End Time	# of Steps Taken	Activity Minutes	Additional Comments
Tuesday, 11/8					
Wednesday, 11/9					
Thursday, 11/10					
Friday, 11/11					
Saturday, 11/12					
Sunday, 11/13					
Monday, 11/14					

WEEK 4					
Date	Start Time	End Time	# of Steps Taken	Activity Minutes	Additional Comments
Tuesday, 11/15					
Wednesday, 11/16					
Thursday, 11/17					
Friday, 11/18					
Saturday, 11/19					
Sunday, 11/20					
Monday, 11/21					

APPENDIX F
PHYSICAL ACTIVITY GUIDELINE EMAIL TEMPLATE

1. Email sent to steps group at the beginning of week 1
2. Email sent to minutes group at the beginning of week 1
3. Email sent to combination group at the beginning of week 1
4. Email sent to control group at the beginning of week 1

Email sent to steps group at the beginning of week 1

GROUP 1

Hello _____ ,

Thank you for completing the baseline questionnaire.

This is the first of four weekly emails that you will receive as part of this program. Look for future emails on Tuesday, instead of Wednesday.

Physical activity has many important physical and mental health benefits. Taking approximately 10,000 steps per day is recommended to achieve these benefits. Accumulating more than 10,000 steps per day results in even greater benefits and increasing your activity (even if you don't get to 10,000 steps) also results in health benefits.

For the next four weeks, we will be providing you with physical activity goals that help you to progressively increase your daily step count. Please use your pedometer to track your step count each day. On your log (attached), please record the time that you wore your pedometer and your daily step count. On Monday, you will receive a link to complete your weekly log online.

Week 1 Goal

Your goal for this week is to increase your daily step-count by 1,500 steps per day on at least 3 days per week.

Your baseline step-count was _____, so **your goal is to take _____ steps per day on at least 3 days this week.**

If you have any questions, please contact physicalactivitystudyECU@gmail.com or 252.737.2266

Thank you again for your continued participation.

Email sent to minutes group at the beginning of week 1

GROUP 2

Hello _____,

Thank you for completing the baseline questionnaire.

This is the first of four weekly emails that you will receive as part of this program. Look for future emails on Tuesday, instead of Wednesday.

Physical activity has many important physical and mental health benefits. Being physically active for 30 minutes per day on 5 days per week is recommended to achieve these benefits. Accumulating more than 30 minutes of activity per day results in even greater benefits and increasing your activity (even if you don't get to 30 minutes) also results in health benefits.

For the next four weeks, we will be providing you with physical activity goals that help you to progressively increase your minutes of daily activity. Please use your pedometer to track your activity minutes each day. On your log (attached), please record the time that you wore your pedometer and your daily activity minutes. On Monday, you will receive a link to complete your weekly log online.

Week 1 Goal

Your goal for this week is to increase your daily activity minutes by 15 minutes on at least 3 days per week.

Your baseline activity minutes were _____, so **your goal is to accumulate _____ activity minutes on at least 3 days this week.**

If you have any questions, please contact physicalactivitystudyECU@gmail.com or 252.737.2266

Thank you again for your continued participation.

Email sent to combination group at the beginning of week 1

GROUP 3

Hello _____,

Thank you for completing the baseline questionnaire.

This is the first of four weekly emails that you will receive as part of this program. Look for future emails on Tuesday, instead of Wednesday.

Physical activity has many important physical and mental health benefits. Taking approximately 10,000 steps per day and accumulating 30 minutes of physical activity on 5 days per week is recommended to achieve these benefits. Accumulating more than 10,000 steps per day and 30 minutes of activity results in even greater benefits and increasing your activity (even if you don't get to 10,000 steps and 30 minutes) also results in health benefits.

For the next four weeks, we will be providing you with physical activity goals that help you to progressively increase your daily step count and activity minutes. Please use your pedometer to track your step count and activity minutes each day. On your log (attached), please record the time that you wore your pedometer, your step count, and your activity minutes. On Monday, you will receive a link to complete your weekly log online.

Week 1 Goal

Your goal is to increase your daily step-count by 1,500 steps per day and to increase your daily activity minutes by 15 minutes on at least 3 days per week.

Your baseline step-count was _____ and your baseline activity minutes were _____, so **your goal is to take _____ steps per day and to accumulate _____ activity minutes on at least 3 days this week.**

If you have any questions, please contact physicalactivitystudyECU@gmail.com or 252.737.2266

Thank you again for your continued participation.

Email sent to control group at the beginning of week 1

GROUP 4

Hello _____ ,

Thank you for completing the baseline questionnaire.

This is the first of four weekly emails that you will receive as part of this program. Look for future emails on Tuesday, instead of Wednesday.

Physical activity has many important physical and mental health benefits. Increasing your physical activity results in more health benefits. Pedometers are tools that can help you to increase your physical activity.

Over the next four weeks, please wear your pedometer daily and use your pedometer to try to increase your physical activity. On your log (attached), please record the time that you wore your pedometer for each day. On Monday, you will receive a link to complete your weekly log online.

If you have any questions, please contact physicalactivitystudyECU@gmail.com or 252.737.2266

Thank you again for your continued participation.

